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TEMCO ELECTRONICS & MISSILES COMPANY
A DIVISION OF LING-TEMCO-VOUGHT, INC.

FINAL REPORT

4 KW VHF LINEAR AMPLIFIER
(Type FA-5438)
FOR

FEDERAL AVIATION AGENCY
SYSTEMS RESEARCH AND DEVELOPMENT SERVICE

PREPARED BY:

TEMCO ELECTRONICS
DALLAS 22, TEXAS

CONTRACT FAA/BRD-400
FAA PROJECT 113-8-2D
DATE: 18 OCTOBER 1962

This report has been prepared by Temco Electronics for the Systems Research and Development Service (formerly Bureau of Research and Development) under Contract No. FAA/BRD-400. The contents of this report reflect the views of the contractor, who is responsible for the facts and the accuracy of the data presented herein, and do not necessarily reflect the official views or policy of the FAA.

TABLE OF CONTENTS

PARAGRAPH OR FIGURE — Page No.

"Temco Electronics, Dallas 22, Texas, 4 KW VHF LINEAR AMPLIFIER, July 25, 1962, 130 pp, including 13 illus., and 2 tables, Final Report."

A B S T R A C T

On 6 June 1961, the Federal Aviation Agency and Vought Electronics, Division of Chance Vought Aircraft, Incorporated, entered into a fixed price contract (FAA/BRD-400) to develop and fabricate a long distance VHF communication ground linear amplifier. The procurement specification was the specification for Project 113-8 issued by the Development Division, Communications Branch of the Bureau of Research and Development.

A breadboard of the amplifier was designed and tested to insure electrical compliance with the specification requirements. After satisfactory completion of tests on this unit, two prototype amplifiers were completed and delivered to the FAA. Each amplifier utilizes two ceramic ML 7007 beam power tubes in push pull operating class AB_1 in a grounded cathode circuit. With the exception of these tubes, the entire amplifier is of solid state construction. The amplifier was designated type FA-5438.

1.0 PURPOSE

The purpose of this contract was to develop a high power VHF linear amplifier to be used in a forward scatter communication system being developed by the FAA. The amplifier was to be designed specifically for operation in conjunction with an FA 5270 driver and a TV-24 exciter, and was to include space for mounting these units in order to provide an overall VHF transmitter covering the frequency range of 118 to 136 mcps. This high power amplifier, operating class AB was to provide 4000 watts of carrier power, (16,000 watts P.E.P.) with an input of no more than 100 watts.

1.1 FACTUAL DATA

Table 1 gives the characteristics of the VHF amplifier developed in this contract. The amplifier satisfactorily completed an acceptance test, a 350 hour life test, and an environmental test. No specification waivers were required. Test data on both of the prototype amplifiers is included in this report.

EQUIPMENT CHARACTERISTICS

4KW VHF Linear Amplifier, Type FA-5438

Procurement Specification	Project 113-8
Frequency Range	118-136 mcps
Input Signal	One amplitude modulated RF Signal
Drive Requirement	100 Watts carrier power
Output Signal	One amplitude modulated RF Signal
Output Power	4000 Watts carrier power
Input Impedance	50 ohms nominal
Output Impedance	50 ohms nominal
Isolation	30 db minimum
Distortion	5 per cent maximum
Power Requirements	Three phase, 60 cps, 208 volts, line to line, 30 KVA
Associated Driver	Type FA-5270 100 watt linear amplifier
Associated Exciter	Type TV-24 8-watt exciter
Weight	
Crated	4000 pounds
Uncrated	3000 pounds

Table 1

2.0 SYSTEM PHILOSOPHY

2.1 Reliability

Reliability was given prime consideration in the design of the subject amplifier. Solid state components were used wherever practicable in preference to tubes to increase the theoretical MTBF of the amplifier. According to specification MIL-R-26474, the following equation is used for MTBF:

$$F_r = 30\ (10)^{-6}\ (N_t) + 15\ (10)^{-6}\ (N_m) + 2\ (10)^{-6}\ (N_s) + 0.5\ (10)^{-6}\ (N_c)$$

$$MTBF = 1/F_r$$

where N_t is the total number of tubes

N_m is the total number of motors and relays

N_s is the total number of semiconductors

N_c is the total remaining components.

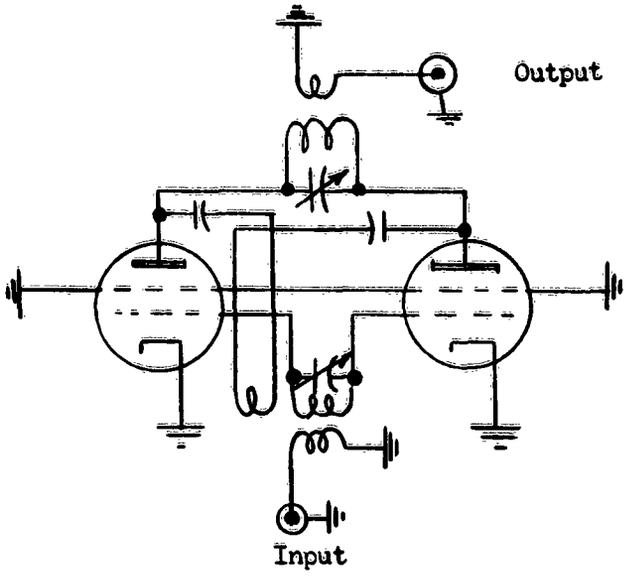
Thus, semiconductors are considered to have a lifetime fifteen times greater than tubes. This contributes greatly to increasing the over-all MTBF of the unit. The calculated MTBF is approximately 2,000 hours.

2.2 Maintainability

Maintainability was also given strong consideration in the design of the amplifier. It would be possible to package the amplifier in a smaller enclosure than the selected cabinet. The large cabinet was selected (to be within specification requirements) but to be sufficiently large to allow easy access to all components.

2.3 Design Considerations

The low frequency equivalent circuit of the linear amplifier is as shown below.



Both plate and grid tuned circuits are made up of half-wave lines tuned capacitively. The tubes are a pair of Machlett ML 7007 beam power tetrodes. A grounded cathode circuit, instead of a grounded grid circuit, was used to obtain a higher gain circuit. Two tubes were used instead of one because no single tube could be found that would allow meeting all the specification requirements. The ceramic type ML 7007 tube was used in preference to the glass type 6166 tube because it requires less drive, will operate at higher temperatures without failure of envelope, and because its demonstrated lifetime is longer. The ML 7007 was designed to be physically interchangeable with the 6166 and, as a result, has certain limitations. The filaments in the ML 7007 are brought out on posts instead of being brought out to coaxial rings. The inductance of the external and internal filament posts limits the upper frequency range of the tube. In addition, this cantilever filament

structure is not as rugged as would be desired, and extreme care must be used in installing or removing a tube to prevent damage of the filament structure. Even with these limitations, the ML 7007 appeared to the best available tube for this application and, as a result, was used.

Push-pull operation was used instead of parallel operation of the tubes to provide a lower second harmonic content. Class AB1 operation was used to provide a more constant input impedance than would be possible with Class AB2 operation. This more constant input impedance, in turn, results in a more over-all linear system. To allow the required power level with Class AB1 operation, a relatively high screen voltage was used (approximately 1825 volts). This high screen voltage also contributes to a high gain amplifier.

The bias point for each tube was selected (when the amplifier is keyed) to be as near zero as considered safe with respect to plate dissipation. This bias point of -140 volts results in a zero signal static plate current of approximately 1.25 amps. With 10 percent high-line voltage, this (worst case) plate dissipation is approximately 10 KW which is near the 12 KW limit of the tube. This bias point is undesirable from the viewpoint of power consumption but is needed in order to provide a high signal to third order distortion ratio needed for single sideband operation. No tube characteristics are available from Machlett for a screen voltage of 1800 volts. Based on extrapolation of data at screen voltages of 800 and 1000 volts, it appears that the zero signal plate current corresponding to maximum signal to distortion ratio for a screen voltage of 1800 volts would be approximately 1.5 amps. This would result in excessive plate dissipation for the tubes; hence, the bias point was chosen as high as considered safe with respect to plate dissipation.

In the unkeyed condition, the bias point was chosen to minimize power consumption as far as practicable while still allowing specification requirements to be met. It would be undesirable to completely cut off the tubes in the unkeyed condition since intermodulation signals would be generated by the amplifier in the presence of strong interfering signals. In the ML 7007 tube, the interelectrode capacitances evidently change somewhat with plate and screen dissipation. This detunes the amplifier and limits how low the screen and plate dissipation can be reduced during non-keyed conditions. A bias voltage of -160 volts corresponding to a plate current of approximately 0.62 amps was chosen as a compromise to reduce the power consumption to a minimum without detuning the amplifier a significant amount.

The gain of any RF linear amplifier is a function of the screen voltage and the filament heating. If the screen voltage were not regulated, it would decrease with applied RF voltage swing. This decrease in screen voltage would, in turn, decrease the gain of the tube with input voltage swing causing a rounding or flattening of the output wave shape of the amplifier.

If the screen voltage were not regulated, the screen voltage would also increase with the input line voltage. The filament voltage, if unregulated, would also increase at the same time. Both these conditions would increase the gain of the amplifier. A decrease in input line voltage would cause the gain to decrease in a similar manner. Thus, the screen voltage was regulated in this amplifier to provide a more linear amplification and to prevent variation of amplifier gain with input line voltage variation. The filament voltage was also regulated to prevent amplifier gain variation with line voltage variation.

3.0 TECHNICAL DISCUSSION

For purposes of discussion, the amplifier can be considered to be comprised of the following units:

1. Power Distribution and Control
2. R. F. Amplifier Assembly
3. Harmonic Filter
4. High Voltage Supply
5. Screen Voltage Supply
6. Bias Voltage Supply
7. Filament Supply

3.1 POWER DISTRIBUTION AND CONTROL

The amplifier was designed to operate from 208 volts line to line, 60 cps, four wire source. Approximately 30 KVA is required. The power distribution and control circuitry provides proper sequential application of this primary power to the amplifier upon energization, provides protection of the amplifier during overload conditions, provides interlocks for safety, and provides proper sequential removal of primary power during shutdown of the amplifier. Provisions are incorporated to allow connecting the high voltage transformer's primary either in a delta or wye connection. When delta connected, the plate supply voltage is approximately 7500 volts, and when wye connected the plate supply voltage is approximately 4300 volts. The lower plate voltage is provided to allow tuning or reduced power operation.

3.2 R. F. AMPLIFIER ASSEMBLY

Figure (6) shows the RF amplifier assembly. Initially it was intended to use a quarter wave shorted line for the plate tank circuit, and a half wave open line for the grid tank circuit. Calculations were made for the plate tank circuit which appeared satisfactory. Using brass tubing sufficiently large to allow finger stock contact around the anode radiator of the tube (6.5 inches o.d.), a line spacing to provide a 131 ohm characteristic impedance, and a line length of approximately six inches, it appeared that little difficulty would be encountered in tuning the 118 to 136 mpcs range by use of a 5 to 25 uuf capacitor connected from plate to plate. Lines were fabricated, and spaced a sufficient amount above a brass plate to simulate the 22 uuf nominal plate to screen capacitance of the tube. Tests agreed reasonably close with the calculations. However, when the tubes were received and cold tests made with the tube capacitances in the circuit, the line length had to be reduced to such a degree that it would not be possible to properly couple to the output balun. Tests on the tubes indicated that the actual screen to plate capacitance was approximately 40 uuf instead of the 22 uuf listed in the tube data sheet. In view of this, one half wave length lines were substituted for the quarter wave length lines.

The plate lines used were 6.5 inches o.d. and spaced 10.75 inches apart. This gives a characteristic impedance in free space as follows:

$$Z_{op} = 120 \cosh^{-1} D/D$$

$$= 120 \cosh^{-1} 10.75/6.5 = \underline{131 \text{ ohms}}$$

The actual characteristic impedance in the rf box would be slightly different due to the capacitance between the lines and the sides and ends of the rf box, but the difference is small.

At the upper end of the frequency band, 136 mcps, the ratio of the tuning capacitance admittance, Y_{c1}, to the line admittance, Y_{op}, is as follows:

$$Y_{c1}/Y_{op} = 2\pi f_{c1} Z_{op}$$

where c_1 is the tuning capacitance, and f is the frequency of operation.

$$Y_{c1}/Y_{op} = 2\ (3.14)(10)(10)^{-12}(131)(136)(10)^{6}$$

$$= 1.12$$

This assumes that at the upper end of the frequency band a capacitance of 10 uuf is to be used. From the foll ing page, it can be seen on the Smith chart that this point is represented by point A. At this same frequency, the ratio of the plate to plate capacitive admittance, Y_{cp} to the line admittance Y_{op} is as follows:

$$Y_{cp}/Y_{op} = 2\pi f\ C_p\ Z_{op}$$

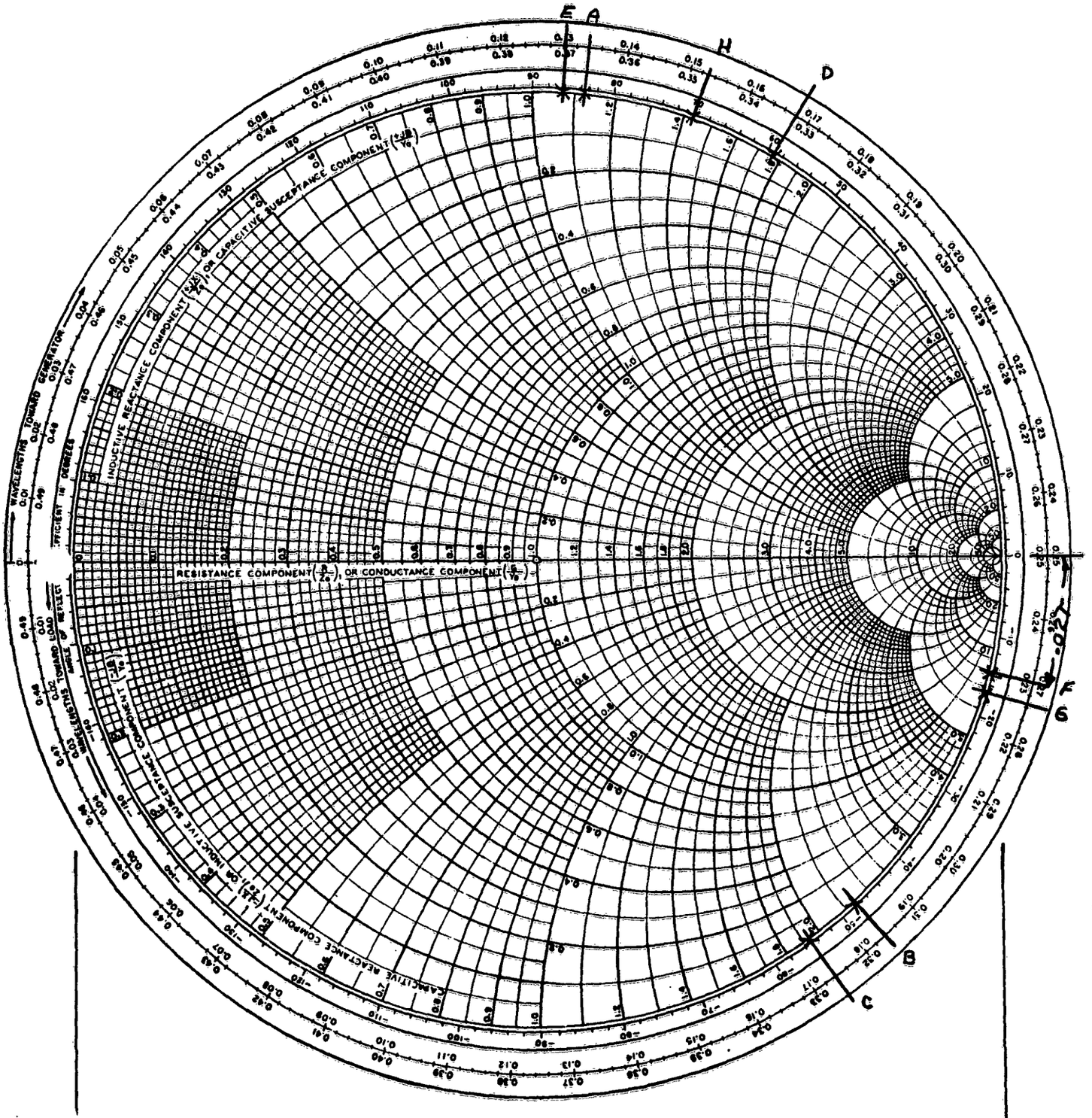
$$= 2\ (3.14)(20)(10)^{-12}(136)(10)^{6}(131)$$

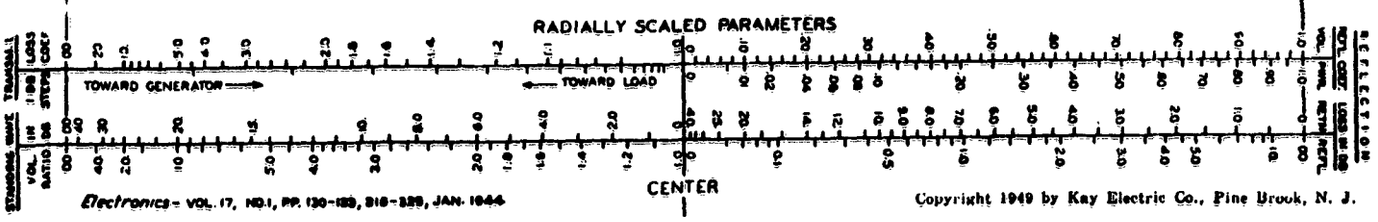
$$= 2.24$$

This is based on the actual tube plate to screen capacitance being 40 uuf instead of the advertised 22uuf, thus giving a plate to plate capacitance of 20 uuf. This point is represented as point B on the Smith chart. Point A corresponds to 0.134 wavelengths, and Point B corresponds to 0.316 wavelengths; the difference being 0.182 wavelengths. One wavelength at this frequency is as follows:

NAME	TITLE	DWG. NO.
SMITH CHART Form 756-N	GENERAL RADIO COMPANY, CAMBRIDGE, MASSACHUSETTS	DATE

IMPEDANCE OR ADMITTANCE COORDINATES



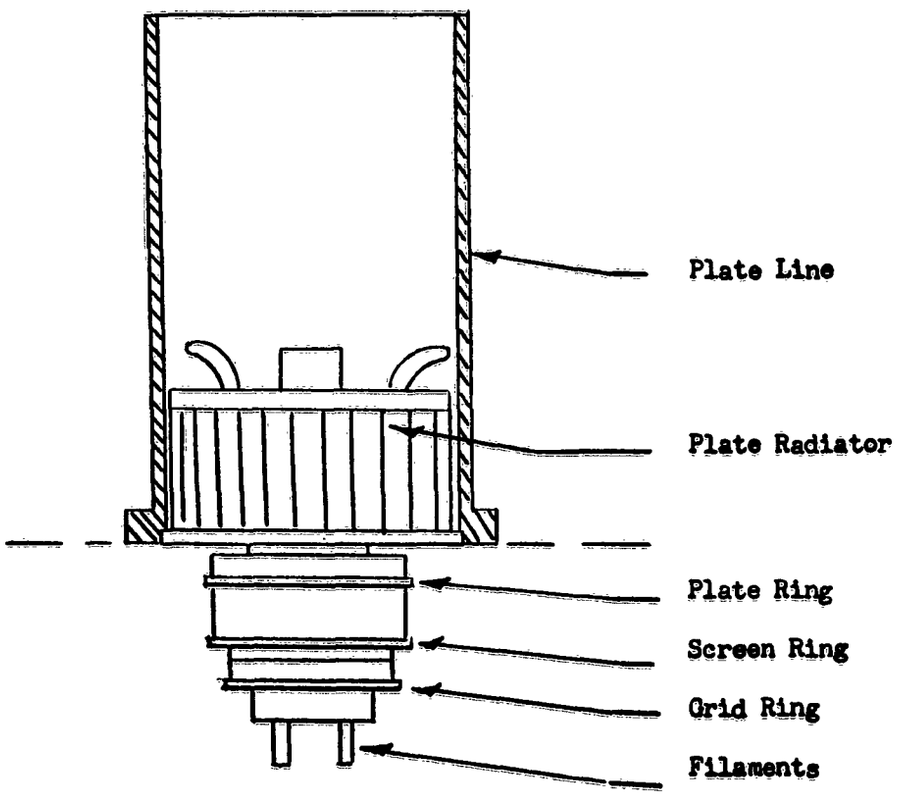


Electronics – VOL. 17, NO. 1, PP. 130-133, 318-320, JAN. 1944

$\lambda = v/f = 3(10)^8 (136)(10)^6 = 2.2$ meters $= 86.6$ inches

$0.182\ \lambda = 15.8$ inches

Thus at this frequency, with a line length of 15.8 inches whose characteristic impedance is 131 ohms, 10 uuf capacitance will cancel out the 20 uuf capacitance between plates giving resonance. Since the plate of the tube is actually between one and two inches below the bottom of the anode radiator on the ML 7007 tube, and since approximately two inches more lead length is involved in attaching the capacitor plates to the lines, the brass tubes were made 12 inches in length



With this length of line the tuning capacitance required for tuning at the lower end of the band, 118 mcps, can now be calculated. At this frequency:

$$\frac{Y_{cp}}{Y_{op}} = 2.24 \left(\frac{118}{136}\right) = 1.945$$

$$\lambda = \frac{3(10)^8}{118(10)^6} = 2.54 \text{ meters} = 100 \text{ inches}$$

Assuming the overall line length to be approximately 15.8 inches

$$\frac{15.8}{100} = 0.158 \text{ wavelengths}$$

The point representing $\frac{Y_{cp}}{Y_{op}} = 1.945$ is point C on the Smith Chart. This corresponds to .326 λ. Going 0.158 wavelengths toward the load on the Smith Chart gives point D which corresponds to $\frac{Y_{cl}}{Y_{op}}$. This gives $\frac{Y_{cl}}{Y_{op}} = 1.77$ at 0.168 λ.

$$\frac{Y_{cl}}{Y_{op}} = 1.77 = 2\pi f c_1 Z_{op} = 6.28 (c_L)(131)(118)(10)^6$$

$C_1 = 18.3$ uuf

Thus a 5 to 25 uuf plate tuning capacitor should be more than adequate for tuning the 118 to 136 mcps range. Initially a Jennings 5 to 25 uuf vacuum capacitor was used in the amplifier. Even with air cooling of this capacitor, the drift in capacitance was excessive so a higher current rating capacitor, an 8 to 40 uuf capacitor was substituted with somewhat better performance but with still excessive drift. Tests made on the capacitor revealed an excessive temperature rise at the end of the capacitor containing the bellows. The manufacturer was contacted about the problem, and a fix was recommended by Temco Electronics to allow the RF current to bypass the bellows. In the Jennings capacitor at VHF frequencies, the bellows act as a resistor since most of the current is located near the surface of the bellows due to skin effect. This heating from the bellows is transferred to the connected plates, causing an expansion of these plates and a resultant increase in capacitance. Figure (1) shows the Jennings capacitor, and Figure (2) shows the recommended change. Due to the required time scale,

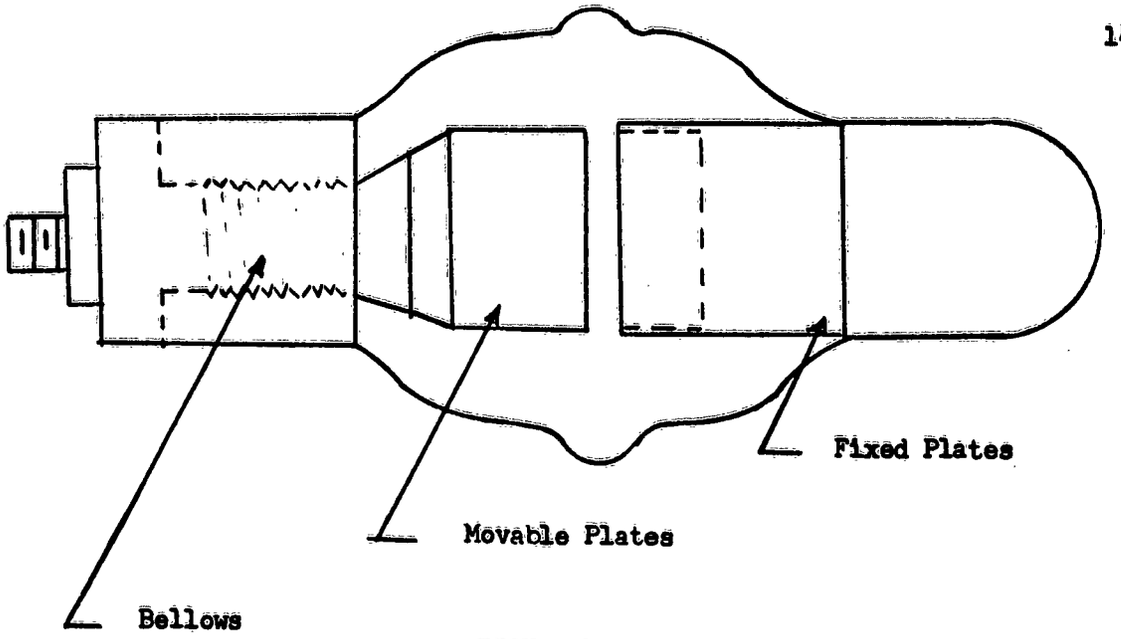


FIGURE 1

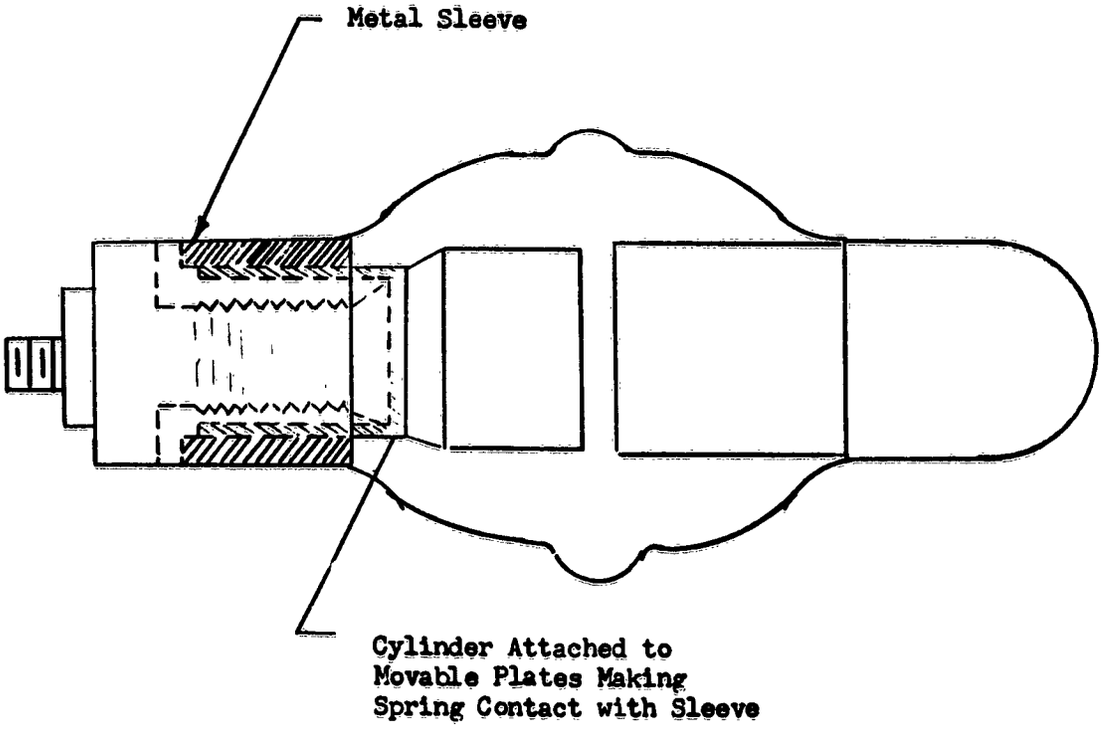


FIGURE 2

Temco Electronics could not afford to wait for a fix, and an air type capacitor was substituted for the vacuum capacitor.

The air type capacitor was made of two circular plates 7.5 inches in diameter. With this diameter, the capacitance as a function of plate separation, in inches, d, is as follows:

$$C = \frac{0.225\ (.7854)(7.5)^2}{d} = \frac{9.9}{d} \quad \text{uuf}$$

Thus, for a capacitance of 10 uuf of 136 mcps

$$d = \frac{9.9}{10} = .99 \text{ inches}$$

and for a capacitance of 18.3 uuf at 118 mcps

$$d = \frac{9.9}{18.3} = .54 \text{ inches}$$

The 0.54 minimum spacing of the capacitor plates should provide a voltage rating in air of 40,000 volts which is sufficient for the amplifier application as long as the amplifier is properly loaded.

Actual tests on the amplifier showed the required spacing of the capacitor plates to be approximately 0.4 inches at 118 mcps and 0.8 inches at 136 mcps.

The grid lines in the 4 kw amplifier were made of brass tubing, 1.375 inches o.d. spaced 3.25 inches apart. This gives a line impedance of 180 ohms

$$Z_{og} = 120 \cosh^{-1} D/D = 120 \cosh^{-1} 3.25/1.375 = 180 \text{ ohms}$$

Assuming that 7 pf will be used to tune the half wave line at 136 mcps, the ratio of the tuning capacitive admittance, Y_{og} is as follows:

$$\begin{aligned} Y_{ci}/Y_{og} &= 2\pi f C_i Z_{og} \\ &= 2(3.14)(136)(10)^6(7)(10)^{-12}(180) \\ &= 1.07 \end{aligned}$$

This point corresponds to point E on the included Smith chart. From the tube data sheet using the 103 uuf total grid to ground input capacity, gives approximately 52 uuf, grid to grid capacitance. The ratio of grid to grid capacitive admittance, Y_{cg}, to the line admittance, Y_{og}, is as follows:

$$Y_{cg}/Y_{og} = 2(3.14)(136)(10)^{6}(52)(10)^{-12}(180)$$
$$= 8.0$$

This point corresponds to point F on the included Smith chart. The difference in wavelengths between these points is as follows:

$$0.27 - 0.13 = .14 \text{ wavelength}$$
$$0.14(86.6) = 12.1 \text{ inches}$$

Allowing 0.1 inches for capacitor brackets, and assuming the lines are approximately 2.5 inches from the grid structure in the tube, leaves 9.5 inches for the line length. The grid lines were cut to this length. The tuning capacitance required for tuning at 118 mcps can be calculated as follows:

$$Y_{ci}/Y_{og} = 2(3.14)(118)(10)^{6}(52)(10)^{-12}(180)$$
$$= 6.95$$

Y_{cg} is the capacitive admittance of the tuning capacitor and Y_{og} is the grid line admittance. This ratio corresponds to point G on the Smith chart. Going 12.1/100 wavelengths toward the load gives point H which gives the required $Y_{ci}/Y_{og} = 1.41$.

$$Y_{ci}/Y_{og} = 1.41 = 2(3.14)(118)(10)^{6}(c)(10)^{-12}(180)$$
$$= 10.5 \text{ uuf}$$

Thus a capacitance of 10.5 uuf is required for tuning at 118 mcps. The actual capacitance required during test for tuning was not measured, but based on the capacity versus turns data supplied with the capacitor, it appears that approximately 8 uuf was required for tuning at 136 mcps, and approximately 12.5 uuf was required for tuning at 118 mcps. These figures are reasonably close to the calculated values, considering the accuracy of the parameters involved.

Initial cold tests on the RF amplifier assembly showed low isolation between the grid and plate circuits. Insufficient voltage was available at the grid ring of the tube to allow conventional cross grid to plate neutralization. In addition, the problem of neutralization was complicated by the self neutralization frequency

of the tube falling within the 118 to 136 mcps range. It can be seen from the the preceding calculations (Point F on the Smith Chart) that the electrical center of the half wave grid lines is only 0.02 wavelengths from the grid. This corresponds to 1.7 inches at 136 mcps, and 2.0 inches at 118 mcps. Thus the voltage minimum on the halfwave lines is almost at the tube grid ring. This verifies that there should be very little voltage at this point for conventional cross neutralization. Since this voltage maximum (current minimum(is near the top of the grid lines, a loop was added near this point to inductively couple a signal for cross neutralization. The loop worked satisfactorily except that a reversal of phase was required in the frequency band. Repeated attempts to lower the screen inductance by better bypassing giving shorter paths to ground failed to raise the self neutralization frequency out of the frequency band. Only by directly shorting of the screen ring to ground could this be accomplished. Thus, it was decided to ground the screen of the amplifier, and to operate the bias and plate voltages with respect to the screen. With the screen grounded, the neutralizing loop worked properly without requiring phase reversal throughout the band. Figure (8) shows the neutralizing loop between and in front of the grid lines. The movable short allows adjustment of coupling to provide optimum isolation. The amplifier when properly neutralized has 35 to 40 db of isolation between grid and plate circuits. For a given set of tubes the movable short, once set, requires little if any change over the frequency band.

Due to the physical size of lines, cabling, brackets, etc, in the RF amplifier, it was not possible to remove all the resonances in the VHF-UHF frequency range. For example, in Figure (8), it can be seen that the filament leads, the wires attached to the grid chokes, the grid chokes, the input balun, capacitor brackets, etc. are all going to be resonant in this frequency range. All these

resonances that could not be removed were staggered so that no resonance in the grid circuit was near the same frequency as any resonance in the plate circuit. Resonance tests were initially made with a 50 ohm dummy load attached to the input balun, and as a result, some resonances in the plate circuit of the FA 5270 driver were overlooked. One resonance near 350 mcps together with a 350 mcps resonance in the plate circuit of the 4 kw amplifier caused an oscillation at this frequency. To remove this instability, a quarter wave trap was added to the input balun. The harmonic filter in the output coaxial cable of the 4 KW amplifier was also moved so that the first inductive element was more nearly an odd number of quarter wavelengths from the output balun. This was done to provide more of a load on the amplifier at this frequency, thus lowering its gain.

3.3 HARMONIC FILTER

Since the second harmonic frequency in a push-pull linear amplifier is normally very far down from the fundamental, little additional filtering should be required of this frequency to insure that it is at least 60 db down from the fundamental. In this 4 KW amplifier, the second harmonic frequency was approximately 54 db down with no filtering. Due to this the harmonic filter need not have a sharp cutoff characteristic in order to suppress both the second and third harmonics. The low pass filter used was made up of four constant K sections mounted in 3 1/8 inch coaxial housing. The filter with its outer conductor removed is shown in Figure (10). Design of the filter was conventional. Cutoff frequency was chosen to be 200 mcps, and the filter was designed for 50 ohms to give minimum insertion loss at 127 mcps, the center of the band. The spacing between the capacitive elements and the inside of the coax outer conductor is approximately 0.312 inches. Assuming "needle gap"characteristics due to the sharp edges of the elements, this gives approximately 9000 volt breakdown voltage.

The filters were actually tested at 10,000 volts without breakdown. The required power rating of the filter is 16,000 watts corresponding to the peak envelope power. Assuming 20,000 watts for safety, this gives a voltage requirement as follows:

$$E^2/50 = 20{,}000$$

$$E = 1000 \text{ volts rms}$$

$$E_{peak} = 1414 \text{ volts}$$

This assumes no standing waves in the filter. With a high vswr, assuming the same forward power, the voltage at a standing wave maximum could reach twice this value or 2828 volts. Thus, the 10,000 volts breakdown should be more than adequate even considering humidity, altitude, and temperature ranges. The filters characteristics are as shown in Figure (3). The actual cutoff frequency of the filter agrees reasonably close to the 200 mcps calculated value. This high cutoff frequency was chosen to minimize insertion loss over the 118 to 136 mcps passband, and also to provide a load on the amplifier at higher frequencies for stability considerations. The point of minimum insertion loss appears to be approximately 10 mcps higher than the 127 mcps calculated.

3.4 HIGH VOLTAGE SUPPLY

The high voltage supply is a conventional three phase supply utilizing full wave rectification with a series choke input filter. The primary windings of the plate transformer are capable of being connected in either a Wye or Delta connection to provide either 4300 or 7500 volts plate supply voltage. The supply is entirely of solid state construction utilizing six stacks of silicon diode cells for rectification. Each diode is bypassed capacitively and resistively to equalize inverse voltages. To limit surge currents through the diodes,

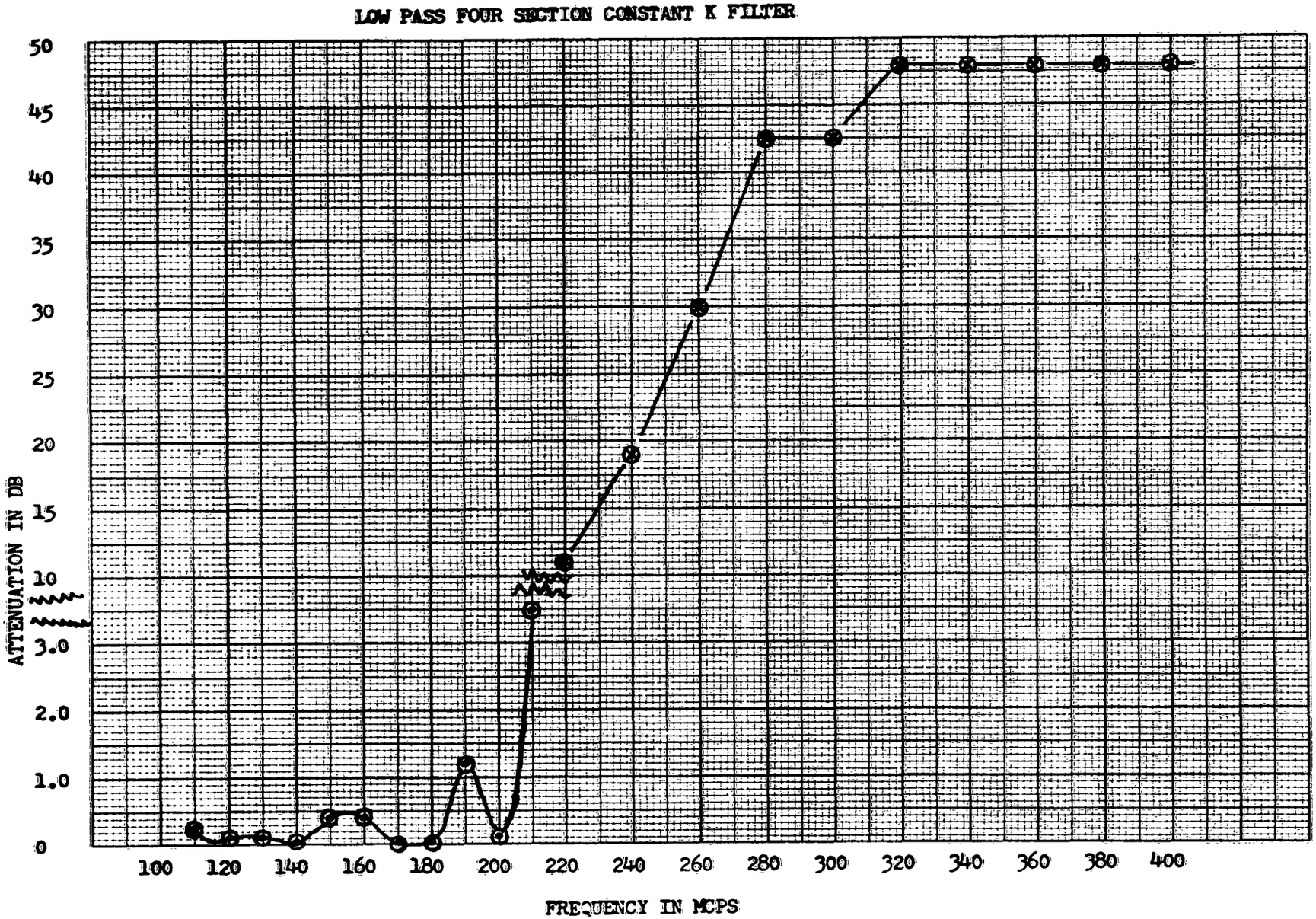

LOW PASS FOUR SECTION CONSTANT K FILTER
ATTENUATION IN DB
50
45
40
35
30
25
20
15
10
3.0
2.0
1.0
0
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
FREQUENCY IN MCPS

Figure 3

resistors are initially placed in series with the filter capacitors. The resistors are shorted by a vacuum switch two seconds after the high voltage supply is energized. This protective feature may not be required for the rectifiers being used, but in view of the cost of a set, the time scale for delivery, and the limited quantity of amplifiers being built, it was incorporated in the two prototype units.

Ten per cent line reactance is provided in the primary of the plate transformer to limit the surge current that can be drawn from the transformer. Thyrite varistors are connected across the dc chokes and line to line across the secondary of the supply to limit voltage spikes which otherwise could possible exceed the peak inverse voltage rating of the rectifiers. Each rectifier stack is rated at 20,000 volts peak inverse voltage which should be considerably more than required in this power supply.

Overload protection of the supply is obtained by the high reactance of the transformer and from a series overload relay. Due to the ten per cent reactance of the transformer, less than 30 amps can be drawn from the supply under short circuit conditions. The rectifiers will withstand this overload current sufficiently long for the overload relay to de-energize the supply. This overload protection was unintentionally satisfactorily tested in the breadboard amplifier when the plate supply voltage was shorted to ground due to insulation melting in the RF amplifier. The polyethylene insulation melted due to rf heating. As a result of this, teflon insulation was used in place of the polyethylene.

3.5 SCREEN VOLTAGE SUPPLY

The screen voltage supply is a series regulated, solid state power supply. The input voltage for the supply is furnished by three constant voltage transformers. The series regulator in the supply maintains a constant output voltage as the current drawn from the supply varies from 0 to 400 ma. and as the line voltage frequency varies plus or minus 1.5 cps from the nominal 60 cps.

3.6 BIAS VOLTAGE SUPPLY

The bias voltage supply is also a series regulated solid state supply. The input to the supply is regulated 115 volts ac, 60 cps, single phase. The bias and screen supplies are interlocked so that loss of bias voltage disconnects the screen voltage from the amplifier. In keying the amplifier, the bias voltage is reduced from -160 volts to -140 volts to increase the gain of the amplifier. Test results on the bias and screen voltage supplies are given in Table (2).

3.7 FILAMENT SUPPLY

Each filament draws 180 amps at 5 volts from an individual transformer. A separate filament transformer is used for each tube to allow monitoring individual cathode currents. The primary winding of each transformer is suppl' d with regulated 115 volts ac from constant voltage transformers. The high reactance of the constant voltage transformer limits the inrush current to a safe value when filaments are first energized.

4.0 SUMMARY

A 4 KW carrier power (16 KW P.E.P.) VHF linear amplifier was developed which covered the frequency range of 118 to 136 mcps and which satisfied the requirements of the FAA specification for Project 113-8. With the exception of the two ceramic beam power tetrodes, the entire amplifier was of solid state construction. Two ML 7007 tubes operating Class AB1 in a grounded cathode circuit were used in the amplifier. An RF harmonic filter made of varying Z_c line sections was used to reduce the second and third harmonic content of the amplifier to the specification levels. Sufficient metering circuitry was included to allow easy set up and tuning of the amplifier. Power distribution and control circuitry was included to automatically sequence and interlock the applied voltages during starting and stopping of the amplifier. All components in the amplifier were significantly derated for reliability considerations.

Two of the amplifiers were completed, satisfactorily tested to insure compliance with the specification requirements, and delivered to the Federal Aviation Agency. The first unit was shipped from Temco Electronics on 25 June 1962. The second unit was shipped from Temco Electronics on 26 July 1962.

BIAS SUPPLY TEST DATA

TEMPERATURE	PERCENT VARIATION	OUTPUT VOLTAGE DC	REGULATOR VOLTAGE DROP	RIPPLE
25°C	0%	131.0 VDC	33.0 VDC	50 mv PP
57°C	-.05%	130.4 VDC	34.5 VDC	50 mv PP
60°C	-.06%	130.2 VDC	36.0 VDC	50 mv PP
61°C	-.06%	130.2 VDC	33.0 VDC	50 mv PP
25°C	0%	131.0 VDC	33.0 VDC	50 mv PP
14°C	+.07%	131.9 VDC	32.0 VDC	50 mv PP
10°C	+.09%	132.1 VDC	31.7 VDC	50 mv PP
6°C	+.09%	132.1 VDC	32.0 VDC	50 mv PP
-1°C	+1.0%	132.3 VDC	32.0 VDC	50 mv PP
-15°C	+1.0%	132.3 VDC	34.5 VDC	50 mv PP

SCREEN SUPPLY TEST DATA

TEMPERATURE	PERCENT VARIATION	OUTPUT VOLTAGE DC	REGULATOR VOLTAGE DROP	RIPPLE
26°C	0%	1625.0	157.0 VDC	1.0 VPP
31°C	0%	1625.0	156.0 VDC	1.0 VPP
40°C	+.035%	1630.0	160.0 VDC	1.25 VPP
50°C	+.065%	1635.0	155.0 VDC	1.25 VPP
66°C	+.095%	1640.0	147.0 VDC	1.50 VPP
21°C	0%	1625.0	143.0 VDC	1.0 VPP
-6°C	-.035%	1620.0	145.0 VDC	0.75 VPP
-10°C	-.065%	1615.0	155.0 VDC	0.75 VPP
-19°C	-.095%	1610.0	157.0 VDC	0.75 VPP

Table 2

PART II

RECOMMENDATIONS

1.0 In future units, consideration should be given to using different type rectifiers in both the screen and high voltage supplies. Improved silicon rectifier stacks are now availabe that are smaller, have higher peak current ratings, and do not require resistor and capacitor bypassing of individual cells.

In future units. an investigation should again be made concerning the use of a vacuum variable plate tuning capacitor. A new line of variable capacitors in development by Jennings uses ceramic instead of a glass housing. These capacitors are supposed to have higher RF current ratings for a given size than their present units. The vacuum variable capacitor would be easier to tune than the present air type, would cover a wider capacitance range, and would probably be less expensive.

The gain of the amplifier is somewhat lower at 136 mcps than at 118 mcps. This is believed due primarily to increased transit time loading. When the amplifier is used in conjunction with the FA-5270 driver, it is recommended for maximum over-all system performance that the FA-5270 driver be adjusted to provide approximately 120 watts instead of 100 watts output at the upper end of the frequency band. With this higher input power, the output coupling can be made tighter while still maintaining 4000-watts carrier output. This tighter coupling (steeper load line) gives a wider RF bandwidth and also minimizes downward carrier shift with maximum modulation.

PART III

1.0 ACCEPTANCE TEST SPECIFICATION

1.1 General Provisions

Tests will be made on one of the two prototype amplifiers to demonstrate that it satisfactorily meets the requirements of the FAA Specification for Project 113-8. These tests will be performed at the manufacturer's facility and will include the following:

a. General Performance - Prior to either the environmental tests or the life test, general performance tests will be run to check out the amplifier at approximately 2 mcps increments across the frequency band.

b. 350 Hour Life Test - One of the two prototypes will be subjected to a 350 hour life test in accordance with paragraph 4.3.1 of the specification for Project 113-8. Records will be maintained and submitted to the Federal Aviation Agency prior to delivery. Data readings will be recorded at 12 hour intervals. Completed records will contain information on operating time, adjustments, malfunctions, replacement, and corrective action, if required.

1.2 Approval of Tests - This specification shall be approved the Federal Aviation Agency prior to conducting tests.

2.0 GENERAL PERFORMANCE

One of the prototype amplifiers will be tested in conjunction with one VHF exciter, type TV-24, and one linear VHF driver, type FA-5270.

2.1 Test Conditions - The conditions under which the equipment will be tested are noted in the following paragraphs unless otherwise noted in the description of an individual test.

2.1.1 Line Voltage - The line voltage will be adjusted by variable transformers to insure 208 volts 60 cps line to line.

2.1.2 Amplifier Input - The exciter and driver will be adjusted as required to provide 100 watts ± 0 percent, -5 percent.

2.1.3 Amplifier Output - With an RF carrier power input of not more than 100 watts, the amplifier output will be adjusted to provide at least 4000 watts carrier power into a 50 ohm resistive load.

2.1.4 Modulation applied to the low level TV-24 exciter will be such as to provide 90 percent modulation. Modulation will be checked at 300, 400, 700, 1000, 1300, 1600, 1900, 2200, 2500, 2700, 2900, and 3000 cps modulating frequency. These tests will be performed at low, medium, and high frequencies in the 118 to 136 mc band.

2.1.5 Test Frequency - Tests will be repeated at approximately 2 mcps increments across the 118 to 136 mcps frequency band unless otherwise specified.

2.1.6 Ambient Temperature - Ambient temperature will be normal laboratory temperature.

2.2 Carrier Power Output - The carrier power output shall be at least 4000 watts at each of the test frequencies.

2.3 Carrier Shift with Line Voltage - The line voltage (line to line) shall be varied from 182 to 225 volts. Carrier power shall not vary more than 400 watts from the nominal 4000 watts.

2.4 Carrier Shift with Audio Modulation - Carrier shift shall be less than 400 watts from the nominal 4000 watts at up to 90 percent modulation.

2.5 Audio Distortion - The distortion of the signal input to the amplifier shall be measured, as well as the distortion of the signal output. The output distortion shall not be more than five percent greater than the input distortion.

2.6 Isolation - With no power applied to the amplifier, the grid and plate circuits will be tuned to resonance. A signal will be applied at either the input or output and the attenuated signal will be measured at the other connector. The attenuation of the signal will be at least 30 db.

2.8 Load VSWR - Using a load to provide a VSWR of 2/1, the amplifier will be tested. Power output shall not decrease by more than 400 watts from the nominal 4000 watts as the coax line length to the load is varied in approximately 0.1 wavelength steps.

2.9 Low Power Operation - At one of the test frequencies, the amplifier will be changed to allow low power operation. The output of the amplifier will be less than 2000 watts with no more than 100 watts input. Carrier shift with audio modulation (90%) will be less than ten percent. Audio distortion added by the amplifier will be less than five percent.

2.10 Input Impedance - With the grid circuit tuned to resonance, the input VSWR shall be less than 1.6 to 1.

2.11 Spurious and Harmonic Radiation - Tests shall be made at each of the test frequencies to insure that spurious and harmonic radiation are at least 60 db down from the fundamental frequency.

3.0 350 HOUR LIFE TEST

The 350 hour life test shall be conducted at a frequency of 127 mcps (mid-band). The test will be continuous, 24 hours a day until completion of the test.

3.1 Test Cycle - The exciter, driver, and amplifier will be set up at the test frequency. With 100 watts ± 0 - 5 percent input, the amplifier will be adjusted to provide in excess of 4000 watts output. A test cycle will be set to provide automatically the following repetitive sequence.

(a) ten minutes carrier off

(b) five minutes - carrier on

3.2 Test Data - At 12 hour intervals, the following tests will be made and all pertinent information recorded. Retuning should not be required during this entire test.

(a) carrier power output

(b) carrier shift with modulation

(c) modulation distortion at 300, 1000, and 3000 cps

4.0 ENVIRONMENTAL TEST

4.1 Temperature and Line Voltage - Install the amplifier in the altitude chamber and set up at the test frequency of 127 mcps for 4000 watts carrier power. Reduce the temperature to -10°C with power applied to the equipment but with no keying. Allow the chamber to stabilize at -10°C for thirty minutes.

Turn carrier on by keying the exciter, and measure carrier power. Reduce the line voltage to 182 volts and repeat. Increase the line voltage to 225 volts and repeat. Record test data. Turn the equipment off and reduce temperature to -55°C. Allow the chamber to stabilize at this temperature for 30 minutes.

4.1.1 Increase the chamber temperature to room temperature and turn the amplifier back on. Operate for five minutes at this temperature to determine any possible malfunction due to the low storage temperature.

4.1.2 Increase the chamber temperature to 60°C and allow it to stabilize for 30 minutes. Turn carrier on and measure output power. Check output power also at 182 volts and 225 volts line voltage. Record test data. Turn the amplifier off and increase the temperature to 70°C. Allow the chamber to stabilize for thirty minutes at this temperature.

4.1.3 Return the chamber to room temperature and operate the amplifier for 5 minutes to determine any malfunction caused by the high storage temperature.

4.2 Altitude - At room temperature and normal line voltage, decrease the pressure in the chamber to simulate 10,000 feet altitude. Allow the chamber to stabilize for 30 minutes. With carrier on, record test data.

4.3 Humidity - With amplifier on buy unkeyed, bring the relative humidity up to 95% at room temperature and pressure equivalent to sea level altitude. Leave the amplifier in the environment for four hours. Apply carrier 5 minutes out of each 15 minute period. Record test data at one hour intervals.

5.0 TEST PROCEDURES

5.1 Isolation - The following test procedures are to be used in performing tests given in paragraph 2.6 of this specification.

5.1.1 Basic Test Setup - Refer to Figure 1A and connect the 4 KW linear amplifier as shown. The following equipments or their equivalents are required for this test:

Equipment	Quantity
VHF Signal Generator (HP 608D)	1
Coax Reducer (31/8 to N connector, Andrews #2262)	1
VSWR and DB Meter (Hewlett Packard 415B)	1
Crystal Holder (PRD 613D)	1
Crystal (1N21B)	1
Attenuator, 6 db	1
Coax Cables (RG-8, RG-87, or equivalent)	-
Coax Connector (Barrel Type-N)	1

5.1.1.1 Detailed Test Procedures - Set the modulation frequency of the signal generator to 1000 cps. Set the signal generator on the desired frequency, 118 mcps. First set the variable attenuator on the signal generator initially to 0 db. Peak the output level with the TRIMMER then reduce the power with the OUTPUT LEVEL knob. Set the MOD LEVEL knob to give 90 percent modulation. On the DB meter, set the BOLOMETER-CRYSTAL knob to the CRYSTAL position, and set the DB scale to the 0 db range. Adjust the GAIN control on the DB Meter to give a zero db indication. If zero db cannot be reached, increase the output level or modulation level of the signal generator; or drop down to the -10 db scale on the DB meter and zero the DB meter on this scale with the GAIN control. Disconnect the two coax cables from the barrel connector and connect as shown in Figure 1B.

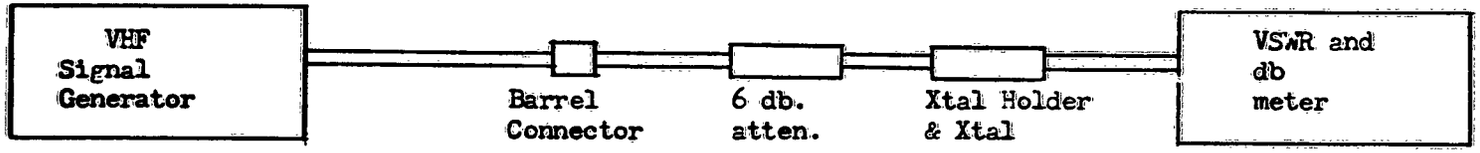


Figure 1A

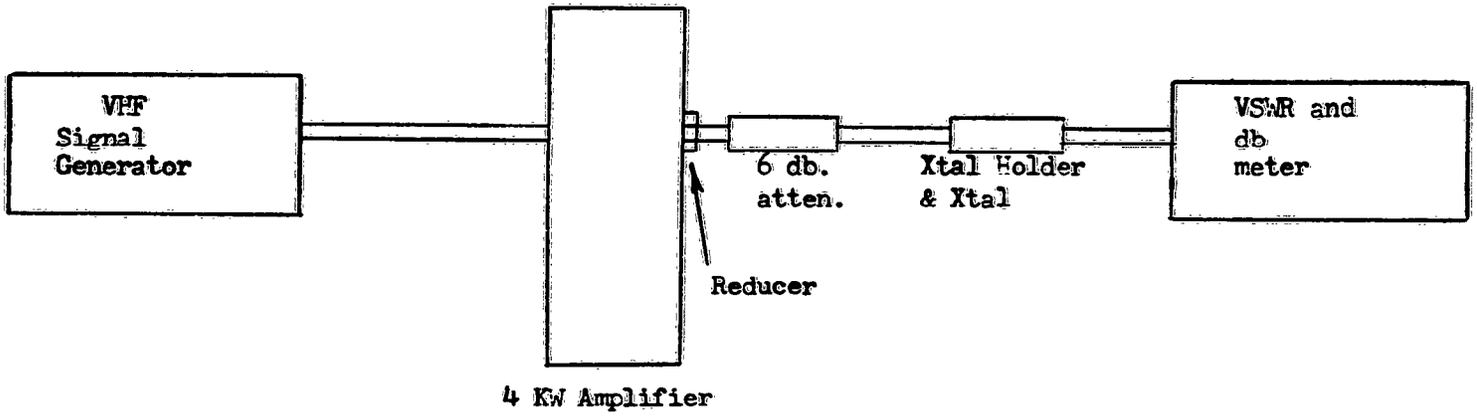


Figure 1B

Use the same coaxial cables as previously used, and do not disturb the settings on the signal generator. Remove the lower front panel from the 4 KW RF box and move the short on the neutralizing loop up as far as possible to provide practically no neutralization of the amplifier. Replace the panel. Using the GRID TUNE and PLATE TUNE dials, tune the amplifier to peak the reading on the DB meter. Initially, drop to a lower scale on the DB meter to allow peak meter tuning. After the amplifier is tuned, again remove the front panel from the lower section of the amplifier and lower the short on the neutralizing loop to the point corresponding to 118 mcps. Replace the front panel, and check the reading on the DB meter. The difference between this reading and 0 (or -10 depending on the initial scale used) gives the isolation between the input and output of the amplifier. This isolation should be at least 30 db. Repeat this entire procedure at 2 mcps increments from 118 mcps to 136 mcps. Isolation at each frequency should be at least 30 db. NOTE: (1) Isolation is independent of modulating frequency; but since a tuned amplifier is used in the DB meter, a modulating frequency of 1000 cps must be used, and (2) tests are to be made with no power of any kind on the amplifier. (Previous tests have shown practically no difference between tests with and without filament voltage, the isolation being one to two db greater with filaments on.)

5.2 Carrier Power Output - The following test procedures are to be used in performing tests given in paragraphs 2.2, 2.9 and 2.10 of this specification.

5.2.1 Basic Test Setup - Refer to Figure 2 and connect the 4 KW amplifier and associated equipment as shown. Set the input line to line voltage to 208 volts. The following equipments or their equivalents are required for this test.

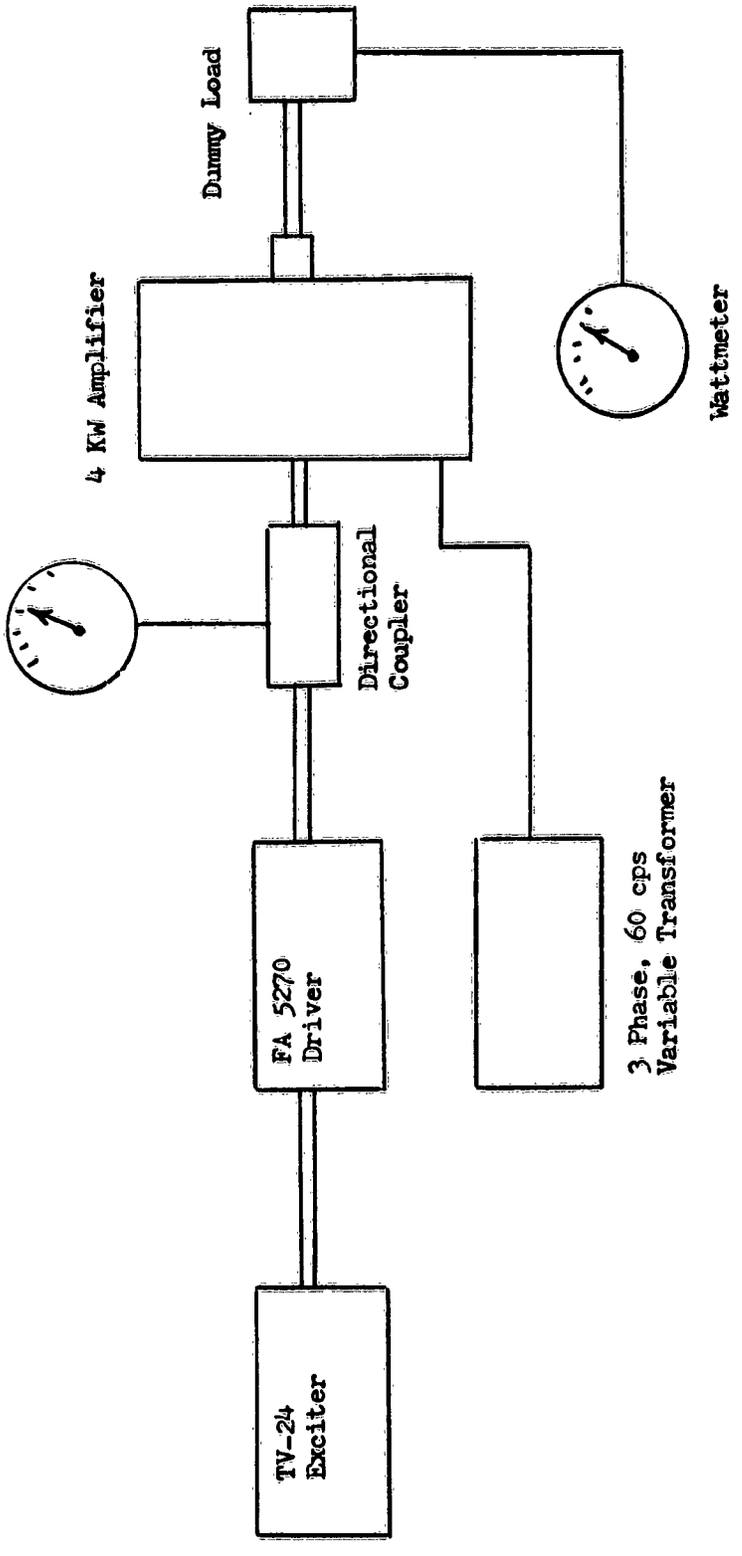

Dummy Load
4 KW Amplifier
Wattmeter
Directional Coupler
FA 5270 Driver
3 Phase, 60 cps Variable Transformer
TV-24 Exciter

Figure 2

Equipment	Quantity
TV-24 Exciter	1
FA-5270 Driver	1
Dummy Load and Wattmeter (Bird Electronics Model 67C)	2
Power Divider (Temco)	1

5.2.1.1 Detailed Test Procedures - Set up the TV-24 exciter and the FA-5270 driver at a frequency of 118 mcps in accordance with the applicable handbooks covering these units. After set up, adjust R13 in the TV-24 to obtain exactly 100 watts carrier power out of the FA-5270 driver, using the 4 KW linear amplifier with power on as a load. Before final adjustment of R13, adjust the GRID TUNE on the 4 KB amplifier for minimum VSWR as read on the FA-5270 driver meter. This VSWR should be less than 1.6 to one. If the minimum VSWR is higher than this, shut down the amplifier, and readjust the coupling between the input balun and the grid lines of the 4 KW linear amplifier. Repeat VSWR measurement. Adjust the PLATE TUNE dial on the 4 KW amplifier for maximum output power as read on the two wattmeters. If the power is less than 4000 watts or significantly more than 4000 watts, shut down the amplifier and adjust the coupling of the output balun, or the position of the short on this balun. Repeat this procedure until the output power is between 4000 and 4500 watts for an input power of 100 watts. After this test is complete, proceed to tests as outlined in the following sections before changing frequency. (At one of the test frequencies, throw the PLATE VOLTAGE TUNE-OPERATE switch to the TUNE position; and using this same basic test setup, demonstrate low power operation.)

5.3 Carrier Shift with Line Voltage - The following test procedures are to be used in performing tests given in paragraph 2.3 of this specification.

5.3.1 Basic Test Setup - Use the same test setup as given in paragraph 5.2 above.

5.3.1.1 Detailed Test Procedures - Set the input carrier power to the 4 KW amplifier to no more than 100 watts by adjustment of R13 in the TV-24 exciter to obtain exactly 4000 watts carrier power. Adjust the input line voltage (line to line) to 182 volts. Readjust R13, if required, to maintain constant carrier input power. Measure and record the carrier power out of the 4 KW amplifier. Repeat this procedure with an input line to line voltage of 225 volts. Reset the line to line voltage to 208 volts before proceeding to further tests.

5.4 Carrier Shift with Audio Modulation and Audio Distortion - The following test procedures are to be used in performing tests given in paragraphs 2.4 and 2.5 of this specification.

5.4.1 Basic Test Setup - Refer to Figure 3 and change the test setup from the one previously used as required. The additional equipments or their equivalents required for this test are as follows:

Equipment	Quantity
Transfer Oscillator (Hewlett Packard 540B)	1
Audio Oscillator (Hewlett Packard 200CD)	1
Adjust. Attenuator (General Radio 874-GA)	1
Adjust. Attenuator (General Radio 874-GA) (Modified for Instl. in 3 1/8 coax)	1
Crystal Detector Mount, PRD 613D	1
Crystal Detector, 1N21B	1
Distortion Analyzer, Hewlett Packard 330B	1
Oscilloscope (Hewlett Packard 130A)	1

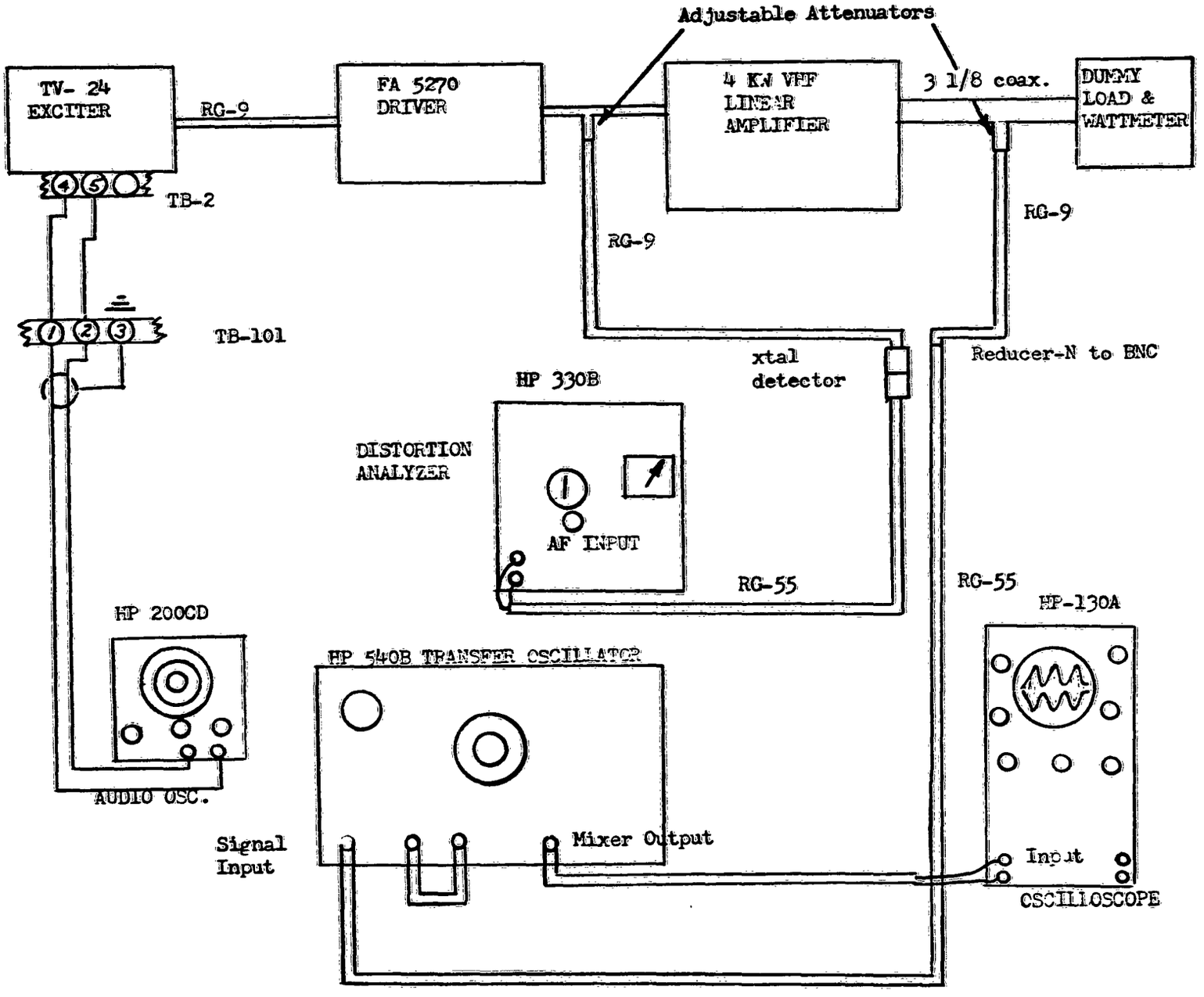

Adjustable Attenuators
TV- 24
EXCITER
RG-9
FA 5270
DRIVER
4 KW VHF
LINEAR
AMPLIFIER
3 1/8 coax.
DUMMY
LOAD &
WATTMETER
TB-2
RG-9
RG-9
TB-101
xtal
detector
Reducer-N to BNC
HP 330B
DISTORTION
ANALYZER
AF INPUT
RG-55
RG-55
HP-130A
HP 200CD
HP 540B TRANSFER OSCILLATOR
AUDIO OSC.
Signal
Input
Mixer Output
Input
OSCILLOSCOPE

FIGURE 3

5.4.1.1 Detailed Test Procedures - Set the audio oscillator frequency to 300 cps, with carrier on (input power 100 watts or less, output carrier power 4000 watts). Throw the KEYING switch at the top of the main control panel to the TEST position. Adjust the AMPLITUDE control of the audio oscillator to give 90 percent modulation as measured on the oscilloscope. With the distortion analyzer, measure the percent distortion of the modulation envelope out of the FA-5270 driver as follows: Set the INPUT dial on the analyzer to the AF position. Using the FREQ RANGE and the COARSE frequency dial, set the analyzer to the modulation frequency (300 cps in this case). Set the FUNCTION switch to the SET LEVEL position. Using the INPUT SENSITIVITY knob, adjust the signal level to give a 100 percent reading on the meter. Switch the FUNCTION switch to the DISTORTION position. Using the FINE frequency control and the BALANCE knob alternately, adjust until the meter indication is nulled. The meter reading is the distortion of the modulation envelope. The METER RANGE control will probably be on the 10 percent scale for this reading.

Remove the cable from the variable attenuator out of the FA-5270 driver and connect the cable from the variable attenuator out of the 4 KW amplifier to the distortion analyzer. Switch the FUNCTION switch back to the SET LEVEL position. Do not disturb the INPUT SENSITIVITY control. Adjust the variable attenuator in the 3 1/8 coax to obtain a 100 percent reading on the distortion analyzer meter. Switch back to the DISTORTION position on the FUNCTION switch and proceed to measure distortion as before. The difference in the two distortion measurements is that contributed by the 4 KW amplifier.

Repeat these tests at modulating frequencies of 400, 700, 1000, 1300, 1600, 1900, 2200, 2500, 2900, and 3000 cps. At one of these modulating frequencies (1000 cps), record input and output carrier shift as the modulation is added and removed.

5.5 Load VSWR - The following procedures are to be used in performing tests given in paragraph 2.8 of this specification.

5.5.1 Basic Test Setup - Use the same test setup as given in section 5.4 with the following exception. Shut down the amplifier. Remove the dummy load from the output coax connector of the 4 KW linear amplifier and connect a 3 1/8 to N type reducer. Connect a teflon type coaxial cable (RG-89, CVC 6020 or equivalent) to the reducer. Connect an N type Tee to the other end of this cable. Out of the Tee connect the two wattmeters. This gives a 25 ohm load on the amplifier which, in turn, gives a 2/1 VSWR.

5.5.1.1 Detailed Test Procedures - With this load on the amplifier, test the distortion contribution of the amplifier and carrier shift using 300 cps audio modulation. Test procedure will be the same as given in paragraph 5.4. Adust the output balun for minimum carrier shift and distortion. Both must be within spec. requirements before proceeding. Record input and output carrier power for five different cable lengths between the N type Tee and the Coax reducer, the cable lengths differing consecutively by approximately 0.1 wavelength.

5.6 Spurious and Harmonic Radiation - The following procedures are to be used in performing tests to insure compliance with paragraph 2.11 of this specification.

5.6.1 Basic Test Setup - The test setup for monitoring spurious and harmonic radiation shall be as shown in Figure 4. Additional equipment requirements from that previously given are as follows:

Equipment	Quantity
Noise and Field Intensity Meter (Empire Devices NF-105)	1
VHF Low Pass Filter (Temco 401-70009-1)	1

5.6.1.1 Detailed Test Procedures - On the Noise and Field Intensity Meter (NFI meter), set the attenuator to the 80 db position. Use the 20 to 200 mcps head on the NFI meter. Tune the head to the carrier frequency. Adjust the variable attenuator from the 4 KW amplifier to provide a full scale reading on the NFI meter. Tune the head across the 20 to 200 mcps range and monitor and record the relative level in db of any possible spurious radiation. Disconnect the 4 KW amplifier from the NFI meter and connect the signal generator. Set the frequency to 200 mcps. Set the signal generator level to provide a certain level on the NFI meter. Leave the generator at this frequency and power level. Switch the head on the NFI meter with the 200-400 mcps head. Tune this head to the generator frequency and note and record any difference in db in signal level from that previously obtained with the lower frequency head. This difference will then be added or subtracted, as required, to readings obtained over the 200 to 400 mcps frequency range.

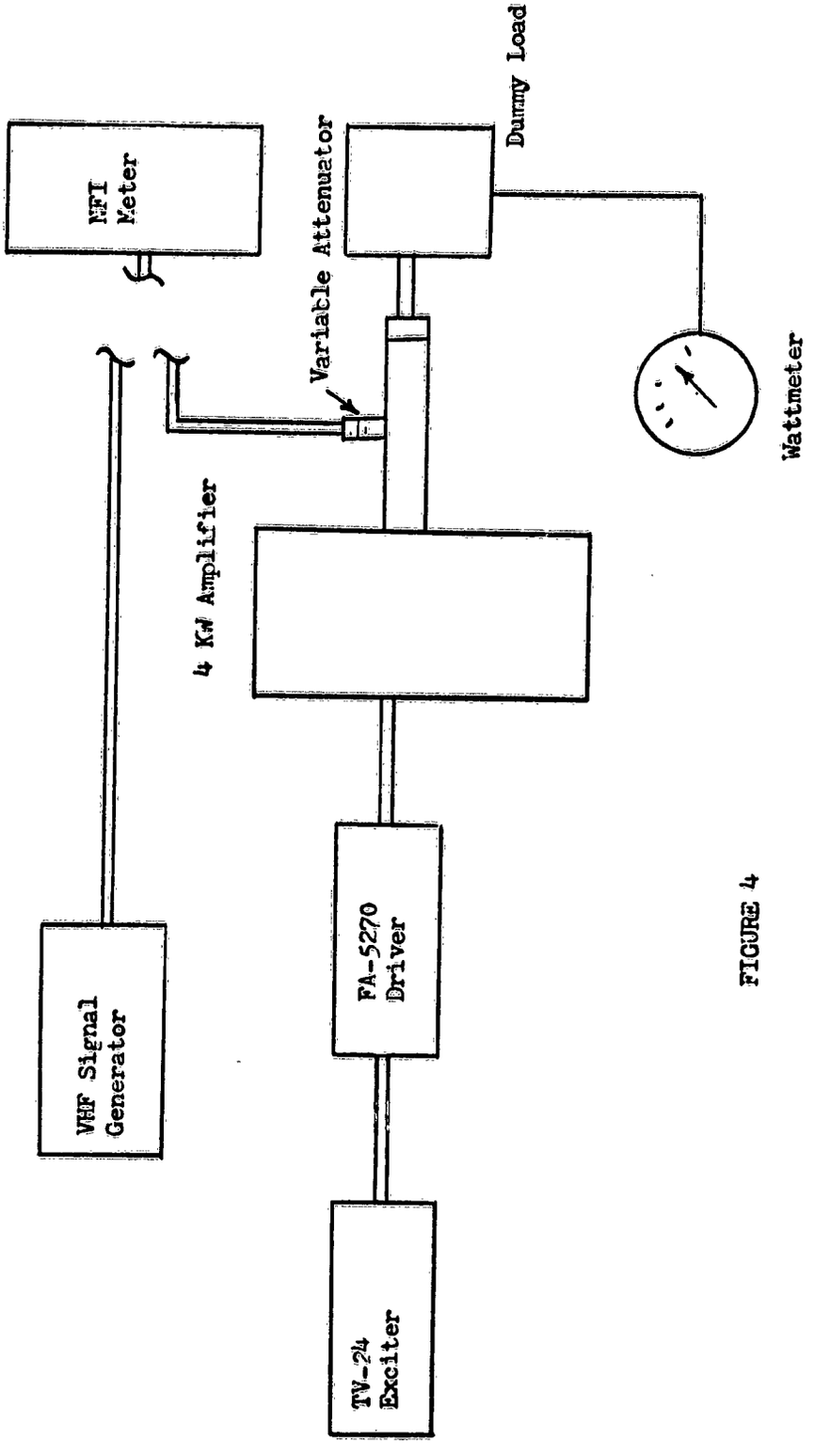

MFI Meter
Variable Attenuator
Dummy Load
Wattmeter
4 KW Amplifier
VHF Signal Generator
FA-5270 Driver
TV-24 Exciter

FIGURE 4

Enclosure (1)

Test Equipment
4 KW VHF Linear Amplifier

DESCRIPTION	NO. REQ.
VHF Signal Generator (Hewlett Packard 608D)	1
Transfer Oscillator (Hewlett Packard 540B)	1
Audio Oscillator (Hewlett Packard 200CD)	1
Distortion Analyzer (Hewlett Packard 330B)	1
VSWR and DB Meter (Hewlett Packard 415B)	1
Oscilloscope (Hewlett Packard 130A)	1
Noise and Field Intensity Meter (Empire Devices Products Corporation, NF-105)	1
Dummy Load, 0-6000 Watts	1
Adjustable Attenuator (General Radio Type 874-GA)	1
Adjustable Attenuator (General Radio 874-GA, Modified and Installed in 3 1/8 inch Coax	1
Crystal Holder (PRD 613D)	2
Crystal (1N21B)	2
Coax Reducer (Andrews #2262)	1

4KW VHF AMPLIFIER
HEAT RUN #1
9 June 1962

TABLE I

Time	Input PWR (Watts)	Output PWR (Watts)		Line Voltage	Temperature in Degrees F				Comments
		Unmod.	Mod.		#3 Exhaust Air	#9 Front of Cabinet	#11 Rear Env. Chamber Door	#12 Rear R.H. Cabinet Door	
1127	100	3850		208	176	118	98	96	Plate Tune 5552 Grid Tune 1332
1134	100	3850		208	185	129	110	104	
1139	100	3775		208	196	143	123	115	
1145	100	3550		208	206	146	128	122	
1150	100	3325		208	214	145	129	126	
1157	100	3150		208	215	150	139	135	
1202									Start of 30 minutes stabilization
1205	100	3000		208	227	151	141	140	
1210	100	2850	2850	208	230	155	142	140	
1220	100	2650		208	232	154	145	144	
1227	100	2525		208	240	156	142	142	
1233	100	2445		208	234	156	141	142	Plate retuned to 5566
1239	100	4050		208	236	155	137	139	
1240	100	3850		182					
1240	100	4050	3850	208					
1241	100	4150		225					
1252	100	4050		208	231	155	141	139	
1257	100	3850		208	232	156	139	140	
1308									Turned off amplifier and raised chamber temperature to 70°C
1420	100	4000	3825	208	Room Temperature				Plate tune 5552
1425	100	4050	3825	208	Room Temperature				Grid Tune 1332

4KW VHF AMPLIFIER
HEAT RUN #2
11 June 1962

TABLE II

Time	Input PWR (Watts)	Output PWR (Watts)		Line Voltage	Temperature in Degrees F				Comments
		Unmod	Mod		#3	#9	#11	#12	
					Exhaust Air	Front of Cabinet	Rear Env. Chamber Door	Rear R.H. Cabinet Door	
1750	100	3950	3550		178		84		Plate and grid tune unchanged throughout test
1827	100	3950	3650		198		133		
1832	100	3750	3450		208	136	139	136	
1837	100	3575	3350		218	157	141	138	
1840	100	3525	3350		221	153	140	140	
1845	100	3800	3550	208	228	148	135	138	(Env. chamber heaters shut down raising line voltage)
1850	100	3500	3350	208	232	147	136	139	
1852	100	3575	3350	208	236	151	138	140	
1858	100	3400	3200	208	233	154	140	142	
1903	100	3425	3200	208	235	158	141	144	

4KW VHF AMPLIFIER
ALTITUDE TEST
9 June 1962

TABLE III

Time	Input Pwr	Output Pwr		Line Voltage	Temperature in Degrees F				Altitude	Remarks
		Unmod	Mod.		#3 Exhaust Air	#9 Front of Cabinet	#11 Rear Env. Chamber Door	#12 Rear R.H. Cabinet Door		
1530	100	3850		208	215	77	75	90	10,500 ft.	
1540	100	3750		208	230	110	87	90	10,500 ft.	
1550	100	3640	3350	208	237	100	87	90	10,500 ft.	
1600	100	3650	3450	208	210	70	68	81	10,500 ft.	Test complete

4KW VHF AMPLIFIER
COLD RUN
10 June 1962

TABLE IV

Time	Input PWR (Watts)	Output PWR (Watts)		Line Voltage	Temperature in Degrees F				Comments
		Unmod.	Mod.		#3 Exhaust Air	#9 Front of Cabinet	#11 Rear Env. Chamber Door	#12 Rear R.H. Cabinet Door	
1133	100	4050	3750	208	192	115	90	90	Plate Tune 5566
1145	100	3750		208	169	20	31	55	Grid Tune 1332
1150	100	2350		208	149	23	20	34	
1155	100	1600		208	143	30	12	16	
1200									Retuned plate to 5539
1206	100	4050		208	120	-9	-4	+8	
1212	100	4000		208	125	+ 12	+15	+14	
1215	100	3950	3750	208	115	+ 12	+ 3	+ 8	
1220	100	4150	3850	208	118	+ 10	+ 5	+14	
1225	100	4050	3775	208	115	36	11	12	
1230	100	3975	3750	208	116	42	16	14	
1231	100	3950	3350	182	113	17	3	10	
1232	100	4000	3800	208					
1233	100	4100	4100	225					
1241									Power turned off
1440					-61	-62.5	-60	-58	
1450					-61	- 64	-62	-60	
1500					-63	- 65	-63	-61	
1505					-62	- 65	-63	-61.5	
1510					-63	- 66	-64	-62.5	
1711	100	4000	3650	208					Plate tuned to 5563
1717	100	4000	3650	208					Test complete

4KW VHF AMPLIFIER
HUMIDITY TEST
11 June 1962

TABLE V

Time	Keying	Input PWR (Watts)	Output PWR (Watts)		Temperature in Degrees F		Relative Humidity	Remarks
			Unmod.	Mod.	#3 Exhaust Air	#11 Rear Env. Chamber Door		
1350	On	100	3800	3650	172	77	100%	Heavy Fog
1355	Off	100	3950	3700	172	79	95%	
1405	On	100	3850	3650	179	[illegible]	95%	
1410	Off	100	3950	3650	177	12	100%	
1420	On	100	3750	3550	176	75	95%	
1425	Off	100	3850	3650	180	89	95%	
1435	On	100	3700	3600	175	84	100%	
1440	Off	100	3950	3700	181	79	92%	
1450	On	100	3700	3600	176	78	95%	
1455	Off	100	3950	3750	183	81	92%	
1505	On	100	3650	3550	177	86	90%	
1510	Off	100	3900	3650	182	85	92%	
1520	On	100	3850	3550	182	85	92%	
1525	Off	100	3800	3600	182	86	90%	
1535	On	100	3850	3600	182	74	90%	
1540	Off	100	3875	3650	186	82	85%	
1550	On	100	3850	3600	178	85	90%	
1555	Off	100	3950	3650	182	78	90%	
1605	On	100	3850	3600	178	85	90%	Shop shutdown at 1612
1610	Off	100	3950	3650	182	78	90%	Raised line voltage
1620	On	100	3950	3650	177	80	90%	
1625	Off	100	3950	3750	184	80	90%	
1635	On	100	4000	3750	187	78	92%	
1640	Off	100	4000	3750	183	84	90%	
1650	On	100	3950	3650	180	71	90%	
1655	Off	100	3950	3650	176	86	92%	
1705	On	100	3850	3600	183	80	90%	
1710	Off	100	4000	3650	180	88	92%	
1720	On	100	3850	3550	175	70	95%	
1725	Off	100	3900	3600	186	69	95%	
1735	On	100	3850	3550	183	84	95%	
1740	Off	100	3950	3600	183	85	92%	
1750	On	100	3950	3550	178	84	92%	Test complete

NO CHANGES MADE IN TUNING

4 KW 350 HOUR LIFE TEST			FA-5270 POWER INPUT	4KW – 0% MOD. POWER OUTPUT	4 KW 90% MOD. POWER OUTPUT	FA-5270 PER CENT DISTORTION			FA-5270 & 4 KW PER CENT DISTORTION			TEST FREQUENCY
DATE	TIME	UNIT HOURS				300 cps	1000 cps	3000 cps	300 cps	1000 cps	3000 cps	(m.c.p.s.)
5-6-62	0830	27.5	100	4000	3950	8.0	9.5	10.5	7.4	8.1	11.0	126.8
5-6-62	1806	34.5	100	4000	3800	8.3	9.6	10.7	7.6	8.3	11.2	"
5-7-62	0830	49.0	100	4000	3750	8.2	9.4	10.5	7.3	8.0	11.0	"
5-10-62	0830	61.8	100	4000	3850	5.5	5.7	8.5	5.3	6.2	6.5	"
5-10-62	1800	71.3	100	4000	3650	10.2	7.8	10.5	8.6	8.9	7.1	"
5-11-62	0830	85.8	100	4000	3700	8.0	7.0	9.3	8.5	8.5	6.4	"
5-11-62	1800	89.0	100	4000	3700	8.2	7.3	9.5	8.8	8.9	7.5	126.8
5-12-62	1130	103.0	100	4000	3820	7.8	3.7	4.8	8.9	7.5	5.6	136.0
5-12-62	1800	107.0	100	4000	3806	7.9	3.8	4.5	8.8	7.8	5.8	"
5-13-62	0730	120.5	100	4000	3810	8.1	4.6	4.6	8.9	7.9	5.9	"
5-13-62	1600	128.3	100	4000	3796	7.8	3.8	4.7	8.7	7.4	5.4	"
5-14-62	0830	142.8	100	4000	3800	7.5	3.9	4.5	8.8	7.5	5.5	"
5-14-62	1800	152.3	100	4000	3730	7.3	3.6	4.7	8.5	7.6	5.6	"
5-15-62	0730	165.8	100	4000	3800	7.6	3.9	4.5	8.9	7.6	5.7	"
5-15-62	1600	174.3	100	4000	4050	11.0	7.8	8.9	8.5	6.0	4.7	118.05
5-16-62	0730	189.4	100	4000	4025	10.5	7.6	9.0	8.4	6.1	4.9	"
5-16-62	1800	198.4	100	4000	4000	10.5	7.8	8.8	8.4	6.2	4.9	"

4 KW 350 HOUR LIFE TEST			FA-5270 POWER INPUT	4KW 0% MOD. POWER OUTPUT	4 KW 90% MOD. POWER OUTPUT	FA-5270 PER CENT DISTORTION			FA-5270 & 4 KW PER CENT DISTORTION			TEST FREQUENCY
DATE	TIME	UNIT HOURS				300 cps	1000 cps	3000 cps	300 cps	1000 cps	3000 cps	(m.c.p.s.)
5-17-62	0806	212.3	100	4000	4050	10.5	7.9	8.8	8.5	6.3	5.0	118.05
5-17-62	1800	220.8	100	4000	4035	11.0	7.8	8.7	8.6	6.2	5.0	"
5-18-62	0730	234.2	100	4000	4025	10.7	7.4	8.3	8.4	6.0	5.1	"
5-18-62	1800	243.2	100	4000	4000	10.5	7.7	8.5	8.5	6.4	5.3	"
5-19-62	0730	256.7	98	4000	3820	9.9	6.0	6.6	7.7	5.4	4.1	126.8
5-19-62	1800	265.8	100	4000	3800	9.5	6.4	6.8	7.4	6.3	4.2	"
5-20-62	0730	279.3	100	4000	3790	9.7	6.3	6.4	7.8	5.5	4.5	"
5-20-62	1600	287.8	98	4000	3790	9.6	6.1	6.5	7.6	5.6	4.4	"
5-21-62	0730	303.3	100	4010	3800	9.5	6.2	6.6	7.8	5.5	4.8	"
5-21-62	1800	312.8	99	4000	3800	9.5	6.3	6.6	7.8	5.4	4.7	"
5-22-62	0730	326.3	100	4000	3810	9.6	6.5	6.0	7.5	5.6	4.6	"
5-22-62	1800	335.7	100	4000	3820	9.8	6.3	6.2	7.6	5.8	4.5	"
5-26-62	1400	335.8	100	4000	3800	7.9	3.5	4.6	8.9	7.4	5.4	136.0
5-28-62	0900	340.8	100	4000	3800	7.4	5.2	5.6	9.6	8.9	7.2	134.3
5-28-62	1500	342.8	100	4000	3920	7.9	5.0	5.4	10.5	9.9	8.3	132.0
5-29-62	1000	344.3	100	4000	4020	7.9	5.1	6.6	8.0	7.0	6.2	130.0
5-30-62	0800	345.0	100	4050	4100	8.9	4.4	5.2	9.0	6.7	5.0	128.0

4 KW 350 HOUR LIFE TEST			FA-5270 POWER INPUT	4KW 0% MOD. POWER OUTPUT	4 KW 90% MOD. POWER OUTPUT	FA-5270 PER CENT DISTORTION			FA-5270 & 4 KW PER CENT DISTORTION			TEST FREQUENCY (MCPS)
DATE	TIME	UNIT HOURS				300 cps	1000 cps	3000 cps	300 cps	1000 cps	3000 cps	
5-30-62	1500	346.6	98	4000	4000	9.9	6.1	6.8	7.8	5.3	4.0	126.0
5-30-62	1600	347.3	100	4000	4000	11.2	7.5	8.4	7.5	5.1	3.9	125.0
5-30-62	1800	348.5	100	4000	3730	8.5	5.8	4.5	11.0	9.3	7.1	123.0
5-31-62	0800	350.1	100	4000	4000	10.5	6.9	8.8	7.4	5.7	6.1	120.9333
5-31-62	1100	351.0	100	4000	4000	9.7	5.6	6.8	7.8	5.3	4.0	119.10
5-31-62	1500	351.5	97	4000	4050	11.5	7.7	8.8	8.3	5.9	4.6	118.05

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 118.05

Test Engineer C. A. McMullen Date 5-31-62

Project Engineer A. R. Cleveland Date 5-31-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here) Unit #1

Plate Tune

Grid Tune

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. Line Voltage 208

1.1 Carrier Frequency 118.05

1.2 Isolation > 30 db Neutr. Shunt Pos. Up 7/8 inches

1.3 Carrier Power Input

Frequency 118.05 Input Power 97

Input VSWR 1.0/1 :

1.4 Carrier Power Output

Frequency 118.05 Output Power 4000

Output VSWR 1.25/1 :

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	Bias	G-1	G-2	
Idle	7300	.72	.80	1835	21	160	0	0	
Carrier	7000	1.30	1.40	1835	105	140	0	0	
Modulation	6950	1.46	1.57	1835	150	140	1.5	1.5	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	97
90% Modulation	4050	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	97	3800	-200
208 volts	97	4000	0
225 volts	97	4050	+ 50

1.8 Audio Distortion

Line Voltage 205 Line Stretcher Wave Length

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.5	8.3	-3.2
400 cps	9.7	7.0	-2.7
700 cps	8.1	5.8	-2.3
1000 cps	7.7	5.9	-1.8
1300 cps	7.7	5.7	-2.0
1600 cps	7.8	5.5	-2.3
1900 cps	7.8	5.3	-2.5
2200 cps	8.1	5.0	-3.1
2900 cps	8.8	4.7	-4.1
3000 cps	8.8	4.6	-4.2

1.9 Spurious and Harmonic Radiation

Frequency mcps	Spurious Signal Level Below 4000 Watt Carrier	
112.5	-63	Receiver Images
97	-46	
32	-77	
25	-80	
21.75	-72	
236.1	-74	
354.15	-80	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1	7	4000	3900	95
0.2	5	3800	4120	100
0.3	3 1/2	3650	3950	100
0.4	6	4000	3900	95
0.5	7	4000	3900	97

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 119.10

Test Engineer C. A. MCMullen Date 5-31-62

Project Engineer A. R. Cleveland Date 5-31-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune

Grid Tune

Output balun short up 6.0" Neutr. Short up 7/8"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 119.10

1.2 Isolation 30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 119.10 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 119.10 Output Power 4000

Output VSWR 1.25 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	[illegible]	G-1	G-2	
Idle	7400	.70	.78	1840	22	160	0	0	
Carrier	7050	1.30	1.40	1840	105	140	0	0	
Modulation	7000	1.46	1.56	1840	150	140	1.0	1.0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3750	-250
208 volts	100	4000	0
225 volts	100	4050	+ 50

1.8 Audio Distortion

Line Voltage _____ Line Stretcher Wave Length _____

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	9.7	7.8	-1.9
400 cps	8.1	6.7	-1.4
700 cps	6.3	5.4	-0.9
1000 cps	5.6	5.3	-0.3
1300 cps	5.7	5.0	-0.7
1600 cps	5.9	4.6	-1.3
1900 cps	5.9	4.4	-1.5
2200 cps	6.4	4.1	-2.3
2900 cps	6.9	3.5	-3.4
3000 cps	6.8	4.0	-2.8

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
97	-46 }
114	-64.5 } Rcvr.
32.5	-72
238.2	-75 db
357.3	-80 db

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Below Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	6"	4000	3900	95
0.2	4"	4000	3900	98
0.3	3-1/2"	3900	3950	100
0.4	6"	4000	3800	95
0.5	6"	4000	3950	98

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 120.93332

Test Engineer C. A. McMullen Date 5-31-62

Project Engineer A. R. Cleveland Date 5-31-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune

Grid Tune

Output balun short 6"

Neutr. Short 7/8" up

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 120.93332

1.2 Isolation > 30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 120.93332 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 120.93332 Output Power 4000

Output VSWR 1.25 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	Bias	G-2	G-2	
Idle	7400	.70	.77	1845	30	160	0	0	
Carrier	7100	1.29	1.39	1845	109	140	0	0	
Modulation	7050	1.45	1.55	1845	143	140	2	1	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3875	-125
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage _____ Line Stretcher Wave Length _____

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	10.5	7.4	-3.1
400 cps	8.8	6.4	-2.4
700 cps	7.8	6.1	-1.7
1000 cps	6.9	5.7	-1.2
1300 cps	7.1	5.7	-1.4
1600 cps	7.3	5.5	-1.8
1900 cps	7.4	5.4	-2.0
2200 cps	8.1	5.4	-2.7
2900 cps	8.8	6.1	-2.7
3000 cps	8.8	6.1	-2.7

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
115	-62 }
99	-44 } RCVR
33	-70 }
241.86664	-74 db
362.79996	-79 db

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	6	3850	4050	100
0.2	3 3/4	3900	4050	100
0.3	5 1/2	3800	3950	100
0.4	6 1/2	3900	3850	100
0.5	6	3750	3900	100

2.1 Environment

Ambient Temperature

Altitude

Humidity

REMARKS:

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 123.0

Test Engineer C. A. McMullen Date 5-30-62

Project Engineer A. R. Cleveland Date 5-30-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune 7090

Grid Tune 0559

Output balun short 5 7/8"

Neutr. Short 7/8"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 123.0

1.2 Isolation >30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 123.0 Input Power 100

Input VSWR 1.01 ; 1

1.4 Carrier Power Output

Frequency 123.0 Output Power 4000

Output VSWR 1.25 ; 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	[illegible]	G-1	G-2	
Idle	7400	.70	.79	1840	25	160	0	0	
Carrier	7150	1.29	1.39	1840	100	140	0	0	
Modulation	7100	1.37	1.48	1840	122	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3730	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3850	-150
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage _____ Line Stretcher Wave Length _____

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	8.5	11.0	2.5
400 cps	7.4	10.0	2.6
700 cps	5.9	9.4	3.5
1000 cps	5.8	9.3	3.5
1300 cps	5.3	8.9	3.6
1600 cps	4.9	8.4	3.5
1900 cps	4.5	8.0	3.5
2200 cps	4.3	7.7	3.4
2900 cps	4.5	7.3	2.8
3000 cps	4.5	7.1	2.6

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier	
117	-63	RCVR
101	-45.5	
34	-65	
246	-79 db	
369	-81 db	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	4 3/4	3900	3800	100
0.2	3 1/2	3600	3650	100
0.3	6	3800	3700	100
0.4	6	3900	3650	90
0.5	4 3/4	3600	3600	100

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 125.0

Test Engineer C. A. McMullen Date 5-30-62

Project Engineer A. R. Cleveland Date 5-30-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune 7234

Grid Tune 0581

Output balun short up 5 7/8"

Neutr. Short up 7/8"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 125.0

1.2 Isolation >30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 125.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 125.0 Output Power 4000

Output VSWR 1.28 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	S-1	Bias	G-1	G-2	
Idle	7500	.70	.79	1845	26	160	0	0	
Carrier	7180	1.29	1.39	1845	100	140	0	0	
Modulation	7100	1.42	1.53	1845	138	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3850	-150
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage _____ Line Stretcher Wave Length _____

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.2	7.5	-3.7
400 cps	9.8	6.3	-3.5
700 cps	8.3	5.1	-3.2
1000 cps	7.5	5.1	-2.4
1300 cps	7.7	5.0	-2.7
1600 cps	7.8	4.8	-3.0
1900 cps	7.9	4.6	-3.3
2200 cps	8.3	4.5	-3.8
2900 cps	8.4	4.0	-4.4
3000 cps	8.4	3.9	-4.5

1.9 **Spurious and Harmonic Radiation**

Frequency	Spurious Signal Level Below 4000 Watt Carrier
118	-62 } RCVR
103	-44.5 } RCVR
250	-77 db
375	-80 db

2.0 **Output Load Variation with 2:1 VSWR**

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	4 1/2	4000	4000	100
0.2	3 1/2	3600	3900	100
0.3	6 1/4	3950	3800	95
0.4	5 1/2	4100	4000	95
0.5	3 1/2	4100	3900	95

2.1 **Environment**

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 126.0

Test Engineer C. A. McMullen Date 5-30-62

Project Engineer A. R. Cleveland Date 5-30-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune 728.6

Grid Tune 0590

Output balun short 6 1/8"

Neutr. Short up 7/8"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 126.0

1.2 Isolation > 30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 126.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 126.0 Output Power 4000

Output VSWR 1.26 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	[illegible]	[illegible]	G-1	G-2	
Idle	7500	.71	.79	1845	29	160	0	0	
Carrier	7200	1.30	1.40	1845	103	140	0	0	
Modulation	7100	1.45	1.56	1845	140	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	98	3820	-180
208 volts	98	4000	0
225 volts	98	4150	+150

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	TV-24, FA-5270 % Distortion	TV-24, FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	9.9	7.8	-2.1
400 cps	8.5	6.5	-2.0
700 cps	6.5	5.3	-1.2
1000 cps	6.1	5.3	-0.8
1300 cps	5.7	5.1	-0.6
1600 cps	5.8	4.9	-0.9
1900 cps	6.0	4.6	-1.4
2200 cps	6.2	4.3	-2.8
2900 cps	6.8	4.0	-2.8
3000 cps	6.8	4.0	-2.8

1.9 **Spurious and Harmonic Radiation**

Frequency		Spurious Signal Level Below 4000 Watt Carrier
104		-45.5 *
119.5		-62.0 } RCVR IMAGES
252	Second Harm.	-80 db
378	Third Harm.	-85 db

2.0 **Output Load Variation with 2:1 VSWR**

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0 0.1	3 1/2	4000	3800	95
0.1 0.2	4	3600	3780	100
0.2 0.3	6	4000	3700	100
0.3 0.4	5	3950	3800	97
0.4 0.5	3 1/2	3650	4000	100
0.5				

2.1 **Environment**

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: * These frequencies not actually present, but are due to receiver images. Same levels were measured using a signal generator input.

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 128.0

Test Engineer C. A. McMullen Date 5-30-62

Project Engineer A. R. Cleveland Date 5-30-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune 7418

Grid Tune 0615

Output balun short 5 7/8"

Neutr up 7/8"

Detail Test Procedure is found in _____ of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 128.0

1.2 Isolation >30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 128.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 128.0 Output Power 4000

Output VSWR 1.28 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	[illegible]	[illegible]-1	[illegible]	[illegible]-1	[illegible]-2	[illegible]
Idle	7450	.69	.76	1845	28	160	0	0	
Carrier	7200	1.30	1.40	1845	105	140	0	0	
Modulation	7160	1.44	1.54	1845	139	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
5% Modulation	4050	100
90% Modulation	4100	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3850	-150
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	8.9	9.0	0.1
400 cps	7.2	8.1	0.9
700 cps	5.3	6.9	1.6
1000 cps	4.4	6.7	2.3
1300 cps	4.4	6.4	2.0
1600 cps	4.5	6.1	1.6
1900 cps	4.8	5.8	1.0
2200 cps	4.7	5.5	0.8
2900 cps	4.9	5.2	0.3
3000 cps	5.2	5.0	-0.2

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier	
142	-56	RCVR
107	-44	
120	-70.5	
111	-86	
256	-80 db	
384	-80 db	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0 0.1	3 3/4	3600	3800	100
0.1 0.2	5 7/8	4000	3950	100
0.2 0.3	5 7/8	3900	3800	100
0.3 0.4	4 1/2	3800	3750	100
0.4 0.5	3 1/2	3600	3750	100
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

REDUCED POWER OPERATION

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 128 mcps

Test Engineer C. A. McMullen Date 6-6-62

Project Engineer A. R. Cleveland Date 6-6-62

Acceptance Test Specification CVA 405-01063

Remarks (Discuss Equipment Failures, etc., here) (LOW POWER TEST)

Plate Tune

Grid Tune Output balun up 6 inches

Detail Test Procedure is found in _____ of

Acceptance Test Specification

1.0 Test Data

Run No. _____ Line Voltage 208

1.1 Carrier Frequency 128

1.2 Isolation >30 db Neutr. Short Pos. 7/8 inches up

1.3 Carrier Power Input

Frequency 128 Input Power 60

Input VSWR 1.1/1 :

1.4 Carrier Power Output

Frequency 128 Output Power 1800

Output VSWR 1.2/1 :

1.5 Amplifier Efficiency

	B+	E-1	E-2	Current	P-1	P-2	C-1	C-2	
Idle	7300	.79	.87	1870	38	160	0	0	
Carrier	7100	1.27	1.38	1860	100	140	0	0	
Modulation	7000	1.35	1.46	1870	110	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	1850	60
90% Modulation	1950	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	60	1750	-100
208 volts	60	1850	--
225 volts	60	1860	+ 10

1.8 Audio Distortion

Line Voltage _____ Line Stretcher Wave Length _____

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	5.2	7.2	+2.0
400 cps	4.5	6.5	+2.0
700 cps	3.9	6.4	+2.5
1000 cps	3.9	6.6	+2.7
1300 cps	4.4	6.8	+2.4
1600 cps	5.0	7.2	+2.2
1900 cps	5.2	7.8	+2.6
2200 cps	5.9	8.5	+2.6
2900 cps	6.4	8.5	+2.1
3000 cps	6.4	8.4	+2.0

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier	
106.5	-45 db	Receiver feed thru
122	-60	
120	-77.5	
256	-76.5 db	
384	-86 db	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature_____

Altitude_____

Humidity_____

REMARKS:_____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 130.0

Test Engineer C. A. McMullen Date 5-29-62

Project Engineer A. R. Cleveland Date 5-29-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune

Grid Tune

Output balun short 5 1/2"

Neutr. short up 7/8"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 130.0

1.2 Isolation >30 db Neutr. Short Pos. 7/8"

1.3 Carrier Power Input

Frequency 130.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 130.0 Output Power 4000

Output VSWR 1.28 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	I-1	I-2	C-1	C-2	
Idle	7450	.70	.78	1845	32	160	0	0	
Carrier	7200	1.31	1.41	1845	105	140	0	0	
Modulation	7180	1.44	1.54	1845	135	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4020	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4050	+ 50

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	7.9	8.0	0.1
400 cps	6.6	7.4	0.8
700 cps	5.4	6.8	1.4
1000 cps	5.1	7.0	1.9
1300 cps	5.3	7.1	1.8
1600 cps	5.6	6.9	1.3
1900 cps	5.8	6.5	0.7
2200 cps	6.0	6.2	0.2
2900 cps	6.1	6.1	0.0
3000 cps	6.6	6.2	-0.4

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
109	-45 RCVR
124	-63
260	-73.5 db
390	-80 db

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	3 5/8"	4000	3950	100
0.2	7"	4000	3700	82
0.3	7"	4000	3950	100
0.4	4 1/8"	4000	3900	100
0.5	5 1/2"	4000	4000	100

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 132.0

Test Engineer C. A. McMullen Date 5-28-62

Project Engineer A. R. Cleveland Date 5-28-62

Acceptance Test Specification

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune

Grid Tune

Output balun short 4.50"

Neutr. Short up .87"

Detail Test Procedure is found in of

Acceptance Test Specification

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 132.0

1.2 Isolation -45 db Neutr. Short Pos. .87"

1.3 Carrier Power Input

Frequency 132.0 Input Power 100

Input VSWR 1.05 : 1

1.4 Carrier Power Output

Frequency 132.0 Output Power 4000

Output VSWR 1.25 : 1

1.5 Amplifier Efficiency

	E+	E-1	E-2	Current	[illegible]-1	[illegible]	C-1	C-2	[illegible]
Idle	7450	.70	.79	1845	23	160	0	0	
Carrier	7200	1.26	1.36	1845	98	140	0	0	
Modulation	7120	1.39	1.49	1845	140	0	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
0% Modulation	4000	100
90% Modulation	3920	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3850	-150
208 volts	100	4000	0
225 volts	100	4120	+120

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	7.9	10.5	2.6
400 cps	6.4	9.6	3.2
700 cps	5.4	9.8	4.4
1000 cps	5.0	9.9	4.9
1[illegible]0 cps	4.9	9.5	4.6
1600 cps	5.2	9.0	3.8
1900 cps	4.3	8.6	4.3
2200 cps	5.3	9.1	3.8
2900 cps	4.4	7.7	3.3
3000 cps	5.4	8.3	2.9

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier	
126	-62.5	Rcvr
110	-45.0	
60.5	-65.0	
264	-71 db	
396	-77 db	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	INCHES	WATTS	WATTS	WATTS
0.1	5 1/4	3850	3850	100
0.2	7.00	4000	3700	90
0.3	5 7/8	3650	3600	100
0.4	3 1/2	4000	3800	100
0.5	5 7/8	4000	3750	92

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 134.3

Test Engineer C. A. McMullen Date 5-28-62

Project Engineer A. R. Cleveland Date 5-28-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune 7840

Grid Tune 0644

Output balun short 4.5"; Neutr short 1.0"; Plate cap.spacing 0.75"

Detail Test Procedure is found in _____ of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 134.3

1.2 Isolation 38.2 db Neutr. Short Pos. 1.0"

1.3 Carrier Power Input

Frequency 134.3 Input Power 100

Input VSWR 1.1 : 1

1.4 Carrier Power Output

Frequency 134.3 Output Power 4000

Output VSWR 1.22 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	[illegible]-1	[illegible]	C-1	C-2	
Idle	7400	.71	.79	1845	40	160	0	0	
Carrier	7150	1.28	1.39	1845	101	140	0	0	
Modulation	7050	1.39	1.50	1845	130	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3800	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4050	+ 50

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	7.4	9.6	2.2
400 cps	6.0	8.9	2.9
700 cps	5.1	8.9	3.8
1000 cps	5.2	8.9	3.7
1300 cps	5.1	8.6	3.5
1600 cps	4.9	8.3	3.4
1900 cps	4.9	7.8	2.9
2200 cps	4.6	8.0	3.4
2900 cps	5.2	7.6	2.4
3000 cps	5.0	7.2	2.2

1.9 Spurious and Harmonic Radiation

Frequency mcps.	Spurious Signal Level Below 4000 Watt Carrier in db	
113	-45	
63	-62	
129	-63	RCVR.
52	-80	
268.6	-69	
402.9	-77	

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0	4.5"	4000	3800	100
0.1	5.0"	4000	3700	100
0.2	6.0"	4000	3750	100
0.3	4 1/4"	3800	3650	100
0.4	3.5"	3750	3750	100
0.5	6.0"	4000	3750	100

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 136 MCPS

Test Engineer C. A. McMullen Date 5-26-62

Project Engineer A. R. Cleveland Date 5-26-62

Acceptance Test Specification CVA 405-01063

Remarks (Discuss Equipment Failures, etc., here)

Plate Tune

Grid Tune Output balun short up 4 1/2 inches

Detail Test Procedure is found in of

Acceptance Test Specification CVA 405-01063

1.0 Test Data

Run No. Line Voltage 208

1.1 Carrier Frequency 136

1.2 Isolation 37.8 db Neutr. Short Pos. 7/8" up

1.3 Carrier Power Input

Frequency 136 Input Power 100

Input VSWR 1.05/1 :

1.4 Carrier Power Output

Frequency 136 Output Power 4000

Output VSWR 1.22/1 :

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	[illegible]-1	[illegible]	G-1	G-2	
Idle	7400	.74	.84	1850	28	159	0	0	
Carrier	7200	1.34	1.44	1850	100	140	0	0	
Modulation	7150	1.44	1.54	1850	127	140	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3820	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length -

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	7.9	8.9	1.0
400 cps	6.3	8.0	1.7
700 cps	4.1	7.7	3.6
1000 cps	3.5	7.4	3.9
1300 cps	3.4	7.2	3.8
1600 cps	3.4	6.7	3.3
1900 cps	3.4	6.3	7.9
2200 cps	3.9	6.0	2.1
2900 cps	4.6	5.6	1.0
3000 cps	4.6	5.4	0.8

1.9 **Spurious and Harmonic Radiation**

Frequency	Spurious Signal Level Below 4000 Watt Carrier in db.
136 mcps	0
115	-42
64	-62 RCVR Feed Thru
130	-59
272	-75 db
408	-79 db
Above 400	Not measurable

2.0 **Output Load Variation with 2:1 VSWR**

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1	6	4000	3700	90
0.2	5 1/4	4000	3600	90
0.3	3 3/4	3750	3600	100
0.4	4 1/2	3800	3600	100
0.5	6	4000	3700	100

2.1 **Environment**

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 118.05

Test Engineer C. A. McMullen Date 7-5-62

Project Engineer A. R. Cleveland Date 7-5-62

Acceptance Test Specification CVA 405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 3/4" fwd short up 5 1/4" from myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA 405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 118.05

1.2 Isolation 30db Neutr. Shunt Pos. 1/2"

1.3 Carrier Power Input

Frequency 118.05 Input Power 100

Input VSWR 1.02 : 1

1.4 Carrier Power Output

Frequency 118.05 Output Power 4000

Output VSWR 1.25 : 1

1.5 Amplifier Efficiency

	B+	E-1	E-2	Screen	C-1	Plate	G-1	G-2	
Idle	7350	.6	.65	1815	10	160	0	0	
Carrier	7050	1.22	1.28	1815	100	139	0	0	
Modulation	7000	1.44	1.50	1815	160	139	+1.0	+1.0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4100	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3950	-150
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	10.75	10.75	0
400 cps	10.0	10.5	.5
700 cps	9.5	10.1	.6
1000 cps	9.75	10.25	.50
1300 cps	10.00	10.25	.25
1600 cps	10.00	10.1	.1
1900 cps	10.10	10.0	.1
2200 cps	10.30	10.25	.05
2900 cps	10.0	9.75	.25
3000 cps	10.0	10.5	.5

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
112.5	-48.5 DB
96	-46 DB
101	-78 DB
236 2nd Harmonic	-80.5 DB
354 3rd Harmonic	-84 DB
110.5	-60 DB
54	-88 DB
32	-75 DB
25	-80 DB
21.5	-68 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1	5 1/4	4000	3800	98
0.2	6 1/2	4000	3600	100
0.3	5.0	4000	3800	100
0.4	3 3/4	4000	3750	100
0.5	5 1/4	4000	3900	100

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 119.1

Test Engineer C. A. McMullen Date 7-5-62

Project Engineer A. R. Cleveland Date 7-5-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/2" fwd short up 6" from myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 119.1

1.2 Isolation 30 db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 119.1 Input Power 100

Input VSWR 1.05 : 1

1.4 Carrier Power Output

Frequency 119.1 Output Power 4000

Output VSWR 1.2 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	[illegible]	[illegible]	G-1	G-2	
Idle	7400	.6	.64	1815	10	160	0	0	
Carrier	7100	1.21	1.28	1815	101	139	0	0	
Modulation	7000	1.41	1.49	1815	160	139	+5	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.0	10.3	.7
400 cps	10.1	9.5	.6
700 cps	9.3	10.0	.7
1000 cps	9.4	9.6	.2
1300 cps	9.5	9.8	.3
1600 cps	9.6	9.8	.2
1900 cps	9.7	9.5	.2
2200 cps	10.0	10.0	.0
2900 cps	10.0	9.5	.5
3000 cps	10.0	9.4	.6

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
113	-60 DB
97	-45.5 DB
111.5	-80.0 DB REC.
238 · 2nd Harmonic	-83.0 DB
357 3rd Harmonic	-88.0 DB
32.5	-82.0 DB
25.5	-74.0 DB
22.0	-70.0 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Transmitter Output Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 120.93332

Test Engineer C. A. McMullen Date 7-5-62

Project Engineer A. R. Cleveland Date 7-5-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/2" fwd. short up 6" from myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 120.93332

1.2 Isolation 30 db Neutr. Shunt Pos. 1/2"

1.3 Carrier Power Input

Frequency 120.93332 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 120.93332 Output Power 4000

Output VSWR 1.15 : 1

1.5 Amplifier Efficiency

	E+	E-1	E-2	Screen	I-1	I-2	C-1	C-2	
Idle	7400	.6	.64	1815	10	160	0	0	
Carrier	7075	1.21	1.27	1815	103	138	0	0	
Modulation	7000	1.40	1.48	1815	160	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3900	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	PA-5270 % Distortion	PA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.75	9.5	2.25
400 cps	10.75	9.4	1.35
700 cps	9.1	8.8	0.3
1000 cps	9.0	7.6	1.4
1300 cps	9.2	7.7	1.5
1600 cps	9.4	7.8	1.6
1900 cps	9.6	7.8	1.8
2200 cps	9.9	8.4	1.5
2900 cps	10.0	9.1	0.9
3000 cps	10.0	9.1	0.9

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
115	-62 db REC.
99	- 45.5 db REC.
33	-70.0 DB REC.
242 2nd Harmonic	-83.0 db
363 3rd Harmonic	-81.0 db
26	78 db REC.

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 123.0

Test Engineer C. A. McMullen Date 7-5-62

Project Engineer A. R. Cleveland Date 7-5-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/4" fwd. short 6" up from myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 123.0

1.2 Isolation 30 db Neutr. Shart Pos. 1/2"

1.3 Carrier Power Input

Frequency 123.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 123.0 Output Power 4000

Output VSWR 1.05 : 1

1.5 Amplifier Efficiency

	D+	E-1	E-2	Screen	[illegible]-1	[illegible]	C-1	C-2	
Idle	7400	.6	.64	1815	10	160	0	0	
Carrier	7100	1.20	1.25	1815	102	138	0	0	
Modulation	7050	1.40	1.48	1815	170	138	0	+.5	

1.6 Carrier Level Shift

	Power Out	Power In
5% Modulation	4000	100
90% Modulation	3900	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4050	+50

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.0	10.0	1.0
400 cps	10.0	10.0	0
700 cps	9.5	10.0	.5
1000 cps	9.3	9.6	.3
1300 cps	9.5	9.9	.4
1600 cps	9.6	9.7	.1
1900 cps	9.5	9.5	0
2200 cps	9.9	9.4	.5
2900 cps	9.6	9.5	.1
3000 cps	9.6	9.3	.3

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
101	- 47 DB REC.
117	- 65 DB REC.
34	- 68 DB REC.
246 2nd Harmonic	-78? DB
369 3rd Harmonic	- 82 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 125.0

Test Engineer C. A. McMullen Date 7-5-62

Project Engineer A. R. Cleveland Date 7-5-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/4" fwd. Short 5 3/4" up from myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 125.0

1.2 Isolation 30 db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 125.0 Input Power 98

Input VSWR 1.02 : 1

1.4 Carrier Power Output

Frequency 125.0 Output Power 4000

Output VSWR 1.01 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	[illegible]	C-1	C-2	
Idle	7400	.6	.64	1815	10	160	0	0	
Carrier	7100	1.20	1.25	1815	100	138	0	0	
Modulation	7000	1.38	1.45	1815	160	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	98
90% Modulation	3900	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	98	3825	-175
208 volts	98	4000	0
225 volts	98	4125	+125

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.0	10.75	.25
400 cps	9.5	10.0	.50
700 cps	9.1	10.0	.90
1000 cps	8.8	10.5	1.70
1300 cps	9.0	10.5	1.5
1600 cps	9.3	10.5	1.2
1900 cps	9.4	10.25	.85
2200 cps	9.6	10.25	.65
2900 cps	9.5	9.7	.20
3000 cps	10.25	9.4	.85

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
103 mc	-45.5 DB REC.
118 mc	-63.0 DB REC.
250 mc 2nd Harmonic	-86.0 DB
375 mc 3rd Harmonic	-87.0 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 126.0

Test Engineer C. A. McMullen Date 7-2-62

Project Engineer A. R. Cleveland Date 7-3-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/4" fwd short up 5 1/2" from Myclex

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 126.0

1.2 Isolation 30db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 126.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 126.0 Output Power 4000

Output VSWR 1.01 : 1

1.5 Amplifier Efficiency

	B+	I-1	I-2	Screen	E-1	E-2	C-1	C-2	
Idle	7400	.61	.65	1815	10	160	0	0	
Carrier	7050	1.22	1.30	1815	104	138	0	0	
Modulation	7000	1.40	1.45	1815	155	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	4000	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	PA-5270 % Distortion	PA-5270 Plus 4mf Linear % Distortion	Difference
300 cps	11.0	9.7	1.3
400 cps	10.5	9.5	1.0
700 cps	9.7	9.4	.30
1000 cps	9.7	8.5	1.2
1300 cps	9.8	8.6	1.2
1600 cps	9.8	8.6	1.2
1900 cps	9.9	8.3	1.6
2200 cps	10.25	8.9	1.35
2900 cps	10.25	9.5	1.75
3000 cps	10.25	9.4	1.85

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
120	-73 DB REC.
104	-45.5 DB REC
110	-88.0 DB REC.
118	-84.0 DB REC.
252 2nd Harmonic	-81.0 DB
378 3rd Harmonic	-82.0 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1	6 1/2	4000	3600	100
0.2	5 1/2	3800	3600	100
0.3	4 1/4	4000	3800	100
0.4	6 1/2	4000	3600	90
0.5	5 1/2	4000	3600	90

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 128.0

Test Engineer C. A. McMullen Date 7-3-62

Project Engineer A. R. Cleveland Date 7-3-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun 1/4" fwd 5 3/8 short up

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 128.0

1.2 Isolation 30 db Neutr. Shunt Pos. 1/2"

1.3 Carrier Power Input

Frequency 128.0 Input Power 100

Input VSWR 1.05 : 1

1.4 Carrier Power Output

Frequency 128.0 Output Power 4000

Output VSWR 1.01 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	[illegible]	[illegible]	C-1	C-2	[illegible]
Idle	7400	.6	.65	1815	10	160	0	0	
Carrier	7050	1.25	1.30	1815	105	138	0	0	
Modulation	7000	1.39	1.46	1815	145	138	-.5	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3900	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3750	-250
208 volts	100	4000	0
225 volts	100	4150	+150

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4MU Linear % Distortion	Difference
300 cps	10.25	10.50	.25
400 cps	9.6	10.50	.90
700 cps	9.4	11.25	1.85
1000 cps	9.8	10.5	.70
1300 cps	10.0	10.75	.75
1600 cps	10.25	11.0	.75
1900 cps	10.5	10.75	.25
2200 cps	10.5	11.25	.75
2900 cps	10.0	11.0	1.0
3000 cps	10.5	10.75	.25

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
107	-44.5 DB REC.
121.5	-63.5 DB REC.
256.0 2nd Harmonic	-79.0 DB
384.0 3rd Harmonic	-81.5 DB

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 130.0

Test Engineer C. A. McMullen Date 7-3-62

Project Engineer A. R. Cleveland Date 7-3-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Readjusted output and input balun 1/4" fowd. Short 5 3/8" up

Detail Test Procedure is found in of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 130.0

1.2 Isolation 30 db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 130.0 Input Power 100

Input VSWR 1.05 : 1

1.4 Carrier Power Output

Frequency 130.0 Output Power 4000

Output VSWR 1.01 : 1

1.5 Amplifier Efficiency

	E+	K-1	K-2	Screen	E-1	Bias	C-1	C-2	
Idle	7350	.6	.64	1815	10	160	0	0	
Carrier	7000	1.25	1.31	1815	110	138	0	0	
Modulation	7000	1.40	1 .46	1815	149	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
5 Modulation	4000	100
90% Modulation	4050	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	
225 volts	100	4150	+150

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	11.75	12.75	1.0
400 cps	11.0	13.5	2.5
700 cps	11.75	13.5	1.75
1000 cps	11.25	13.0	1.75
1300 cps	11.75	13.25	1.50
1600 cps	12.00	13.5	1.50
1900 cps	12.00	13.5	1.50
2200 cps	12.25	14.25	2.00
2900 cps	12.0	13.75	1.75
3000 cps	12.0	13.75	1.75

1.9 **Spurious and Harmonic Radiation**

Frequency	Spurious Signal Level Below 4000 Watt Carrier
108	-45.5 db Rec.
124	-64.5 db Rec.
390 3rd Harmonic	-80 db
260 2nd harmonic	-72 db

2.0 **Output Load Variation with 2:1 VSWR**

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 **Environment**

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 132.0

Test Engineer C. A. McMullen Date 7-3-62

Project Engineer A. R. Cleveland Date 7-3-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun max, back position. Short 5 1/4" from bottom

Detail Test Procedure is found in _____ of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 1 Line Voltage 208

1.1 Carrier Frequency 132.0

1.2 Isolation 30 db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 132.0 Input Power 100

Input VSWR 1.01 : 1

1.4 Carrier Power Output

Frequency 132.0 Output Power 4000

Output VSWR 1.01 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	[illegible]	C-1	C-2	
Idle	7400	.60	.65	1815	10	160	0	0	
Carrier	7100	1.23	1.30	1815	109	138	0	0	
Modulation	7100	1.36	1.45	1815	150	138	-1	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3800	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	
208 volts	100	4000	0
225 volts	100	4150	

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	10.0	12.25	2.25
400 cps	9.5	12.25	2.75
700 cps	10.0	12.5	2.5
1000 cps	9.6	12.5	2.9
1300 cps	9.6	13.0	3.4
1600 cps	9.8	12.75	2.95
1900 cps	9.9	12.75	2.85
2200 cps	10.75	13.00	2.25
2900 cps	10.5	11.5	1.0
3000 cps	10.25	12.75	2.50

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
110	-45.5db Rec.
125	-64.5db Rec.
60.5	-68.5db Rec.
264 2nd Harmonic	-77db
396 3rd Harmonic	-81 db

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature

Altitude

Humidity

REMARKS:

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 134.3

Test Engineer C. A. McMullen Date 7-2-62

Project Engineer A. R. Cleveland Date 7-2-62

Acceptance Test Specification CVA-405-01063

Remarks (Discuss Equipment Failures, etc., here) Unit Number 2

Plate Tune

Grid Tune

Output balun max. back position, short up 4 7/8"

Detail Test Procedure is found in _____ of

Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 3 Line Voltage 208

1.1 Carrier Frequency 134.3

1.2 Isolation > 30 db Neutr. Shart Pos. 1/2"

1.3 Carrier Power Input

Frequency 134.3 Input Power 100

Input VSWR 1.04 : 1

1.4 Carrier Power Output

Frequency 134.3 Output Power 4000

Output VSWR 1.05 : 1

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	G-1	Bias	G-2	G-2	
Idle	7300	.6	.62	1815	10	160	0	0	
Carrier	7100	1.22	1.29	1815	105	138	0	0	
Modulation	7050	1.34	1.41	1815	140	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3700	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	--
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	8.7	10.0	1.3
400 cps	7.7	10.3	2.6
700 cps	6.9	10.3	3.4
1000 cps	6.6	11.5	4.9
1300 cps	7.1	11.7	4.6
1600 cps	7.4	11.0	3.6
1900 cps	7.4	10.0	2.6
2200 cps	7.6	9.8	2.2
2900 cps	8.0	9.4	1.4
3000 cps	8.1	9.0	0.9

1.9 Spurious and Harmonic Radiation

Frequency	Spurious Signal Level Below 4000 Watt Carrier
128	-42db Rec.
113	-44db Rec.
126	-63db Rec.
118	-78db Rec.
63	-70db Rec.
51	-83db Rec.
209	-81db Rec.
272 2nd Harmonic	-70db
408 3rd Harmonic	-87db

2.0 Output Load Variation with 2:1 VSWR

Line Stretcher Wave Length	Output Meter Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1				
0.2				
0.3				
0.4				
0.5				

2.1 Environment

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PERFORMANCE TEST REPORT

4KW LINEAR AMPLIFIER

Frequency 136.0

Test Engineer C. A. McMullen Date 6-28-62

Project Engineer A. R. Cleveland Date 6-28-62

Acceptance Test Specification CVA-405-01063 Unit Number 2

Remarks (Discuss Equipment Failures, etc., here) Transistors installed in screen supply

Plate Tune 191.1

Grid Tune 523.9

Balun Max Back

Short 4 1/4" uf

Detail Test Procedure is found in _____ of Acceptance Test Specification CVA-405-01063

1.0 Test Data

Run No. 2 Line Voltage 208

1.1 Carrier Frequency 136.0

1.2 Isolation >30 db Neutr. Short Pos. 1/2"

1.3 Carrier Power Input

Frequency 136.0 Input Power 100 watts

Input VSWR 1.05/1 : _____

1.4 Carrier Power Output

Frequency 136.0 Output Power 4000

Output VSWR 1.01/1 : _____

1.5 Amplifier Efficiency

	B+	K-1	K-2	Screen	E-1	Bias	G-1	G-2	*
Idle	7400	.55	.60	1820	12	161	0	0	
Carrier	7050	1.2	1.28	1820	120	138	0	0	
Modulation	7050	1.35	1.44	1820	178	138	0	0	

1.6 Carrier Level Shift

	Power Out	Power In
% Modulation	4000	100
90% Modulation	3850	

1.7. Power Out Stability

Input Voltage	Input Power	Output Power	Variation
182 volts	100	3800	-200
208 volts	100	4000	0
225 volts	100	4100	+100

1.8 Audio Distortion

Line Voltage 208 Line Stretcher Wave Length 0

Audio Frequency	FA-5270 % Distortion	FA-5270 Plus 4KW Linear % Distortion	Difference
300 cps	7.0	11.0	3.0
400 cps	5.8	10.5	4.7
700 cps	5.6	10.0	4.4
1000 cps	5.6	10.5	4.9
1300 cps	5.4	10.0	4.6
1600 cps	5.4	10.0	4.6
1900 cps	5.2	9.5	4.3
2200 cps	5.7	9.0	3.3
2900 cps	6.3	8.2	1.9
3000 cps	6.3	8.0	1.7

1.9 **Spurious and Harmonic Radiation**

Frequency	Spurious Signal Level Below 4000 Watt Carrier
130	-52db Rec.
114.5	-44db Rec.
63.5	-60db Rec.
52	-81db Rec.
118	-78db Rec.
127	-64db Rec.
213	-65db Rec.
273 2nd Harmonic	-63.5db
408 3rd Harmonic	-90db

2.0 **Output Load Variation with 2:1 VSWR**

Line Stretcher Wave Length	Output Balun Short Position	Transmitter Output Unmod.	Mod.	Power Input
0.0				
0.1	3 1/2"	4000	3650	95
0.2	4 1/4"	4000	3700	100
0.3	6"	4100	3800	95
0.4	4 3/4"	4000	3700	98
0.5	3 1/4"	4000	3650	100

2.1 **Environment**

Ambient Temperature _____

Altitude _____

Humidity _____

REMARKS: _____

PART V

1.0 PHOTOGRAPHS

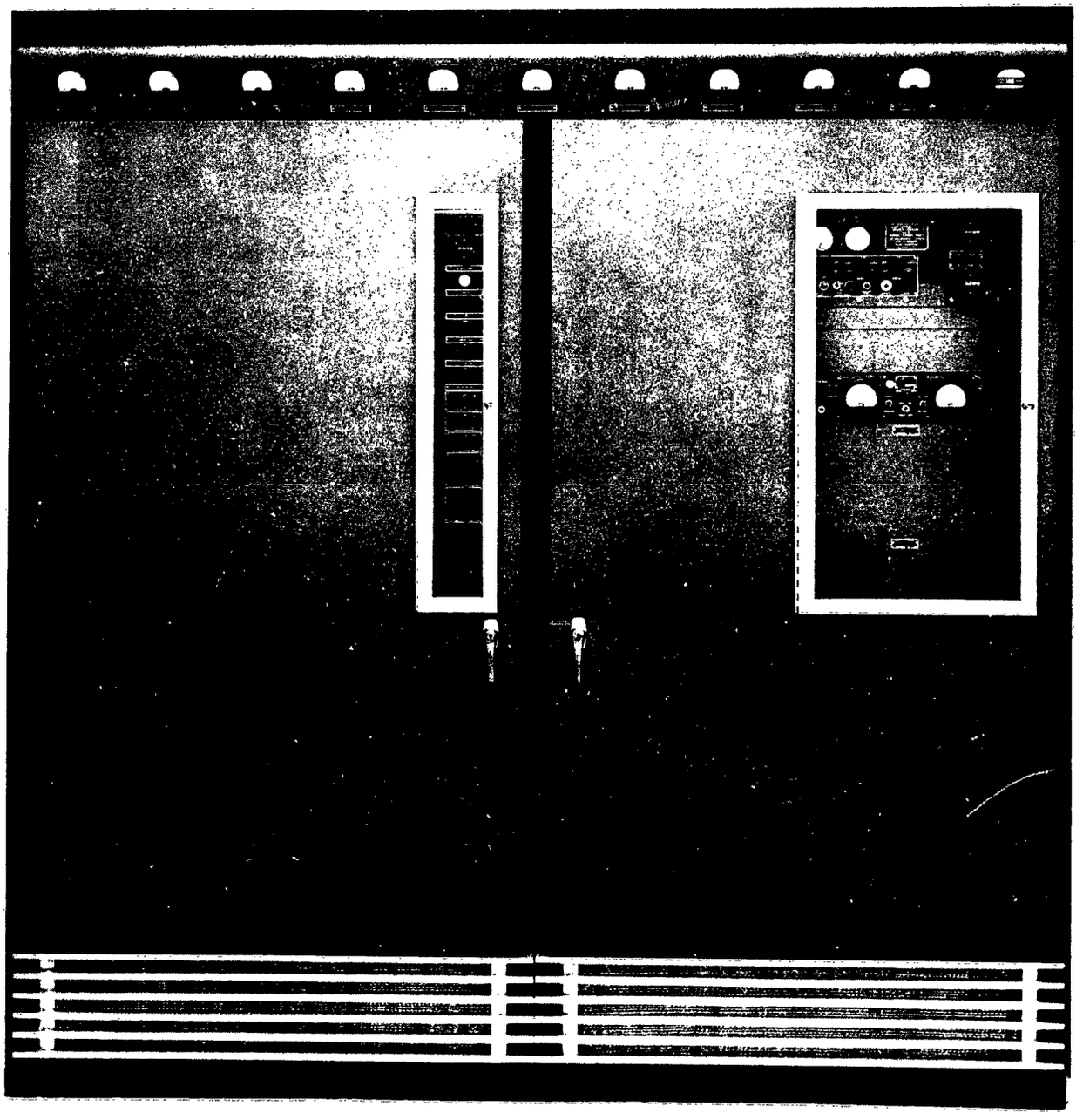


FIGURE 4 - FOUR KW AMPLIFIER, FRONT VIEW

FIGURE 5 - FOUR KW AMPLIFIER, EXPOSED FRONT VIEW

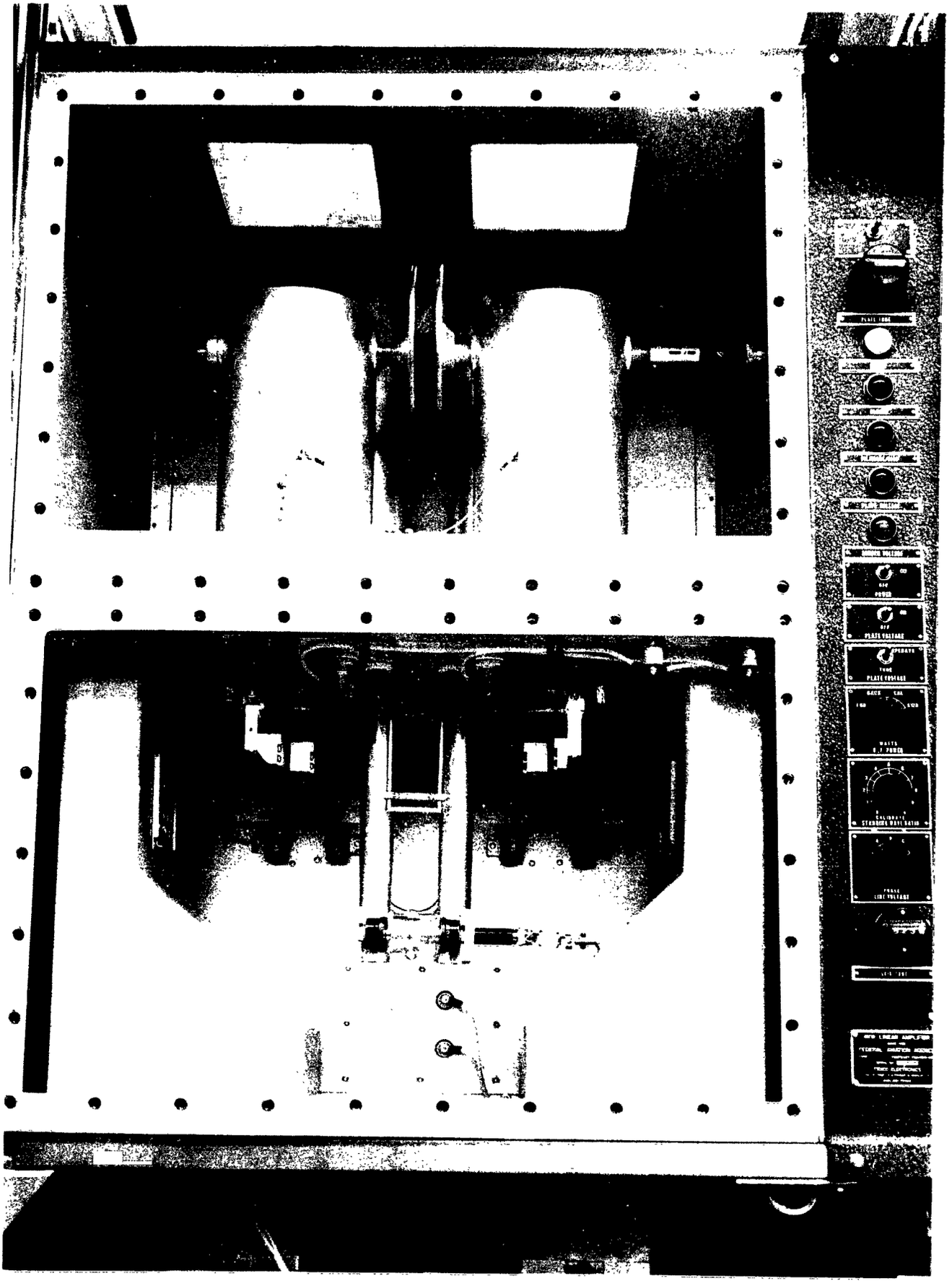


FIGURE 6 - RF UNIT, FOUR KW AMPLIFIER

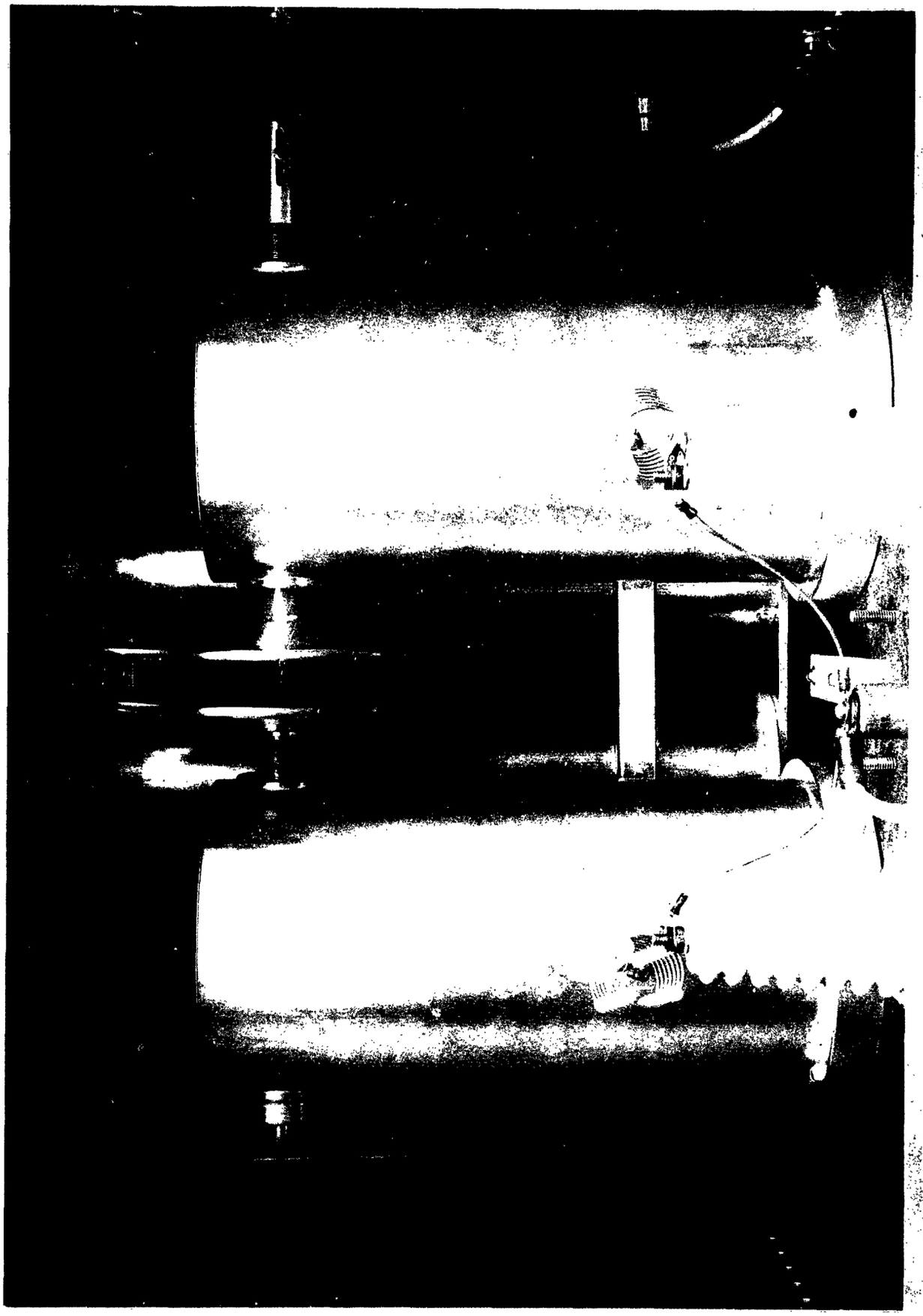


FIGURE 7 - PLATE TANK CIRCUIT, RF UNIT

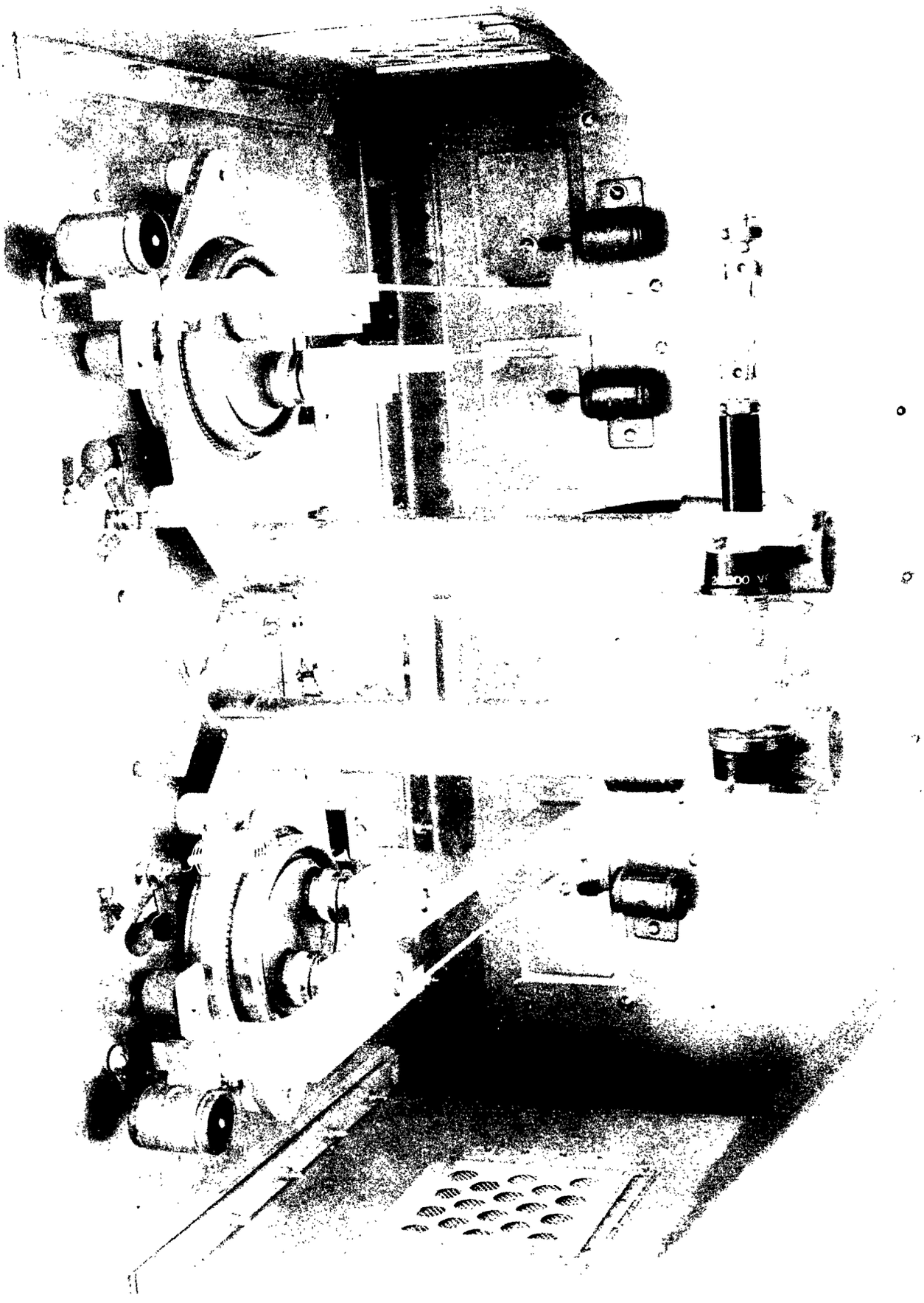


FIGURE 8 - GRID TANK CIRCUIT, RF UNIT

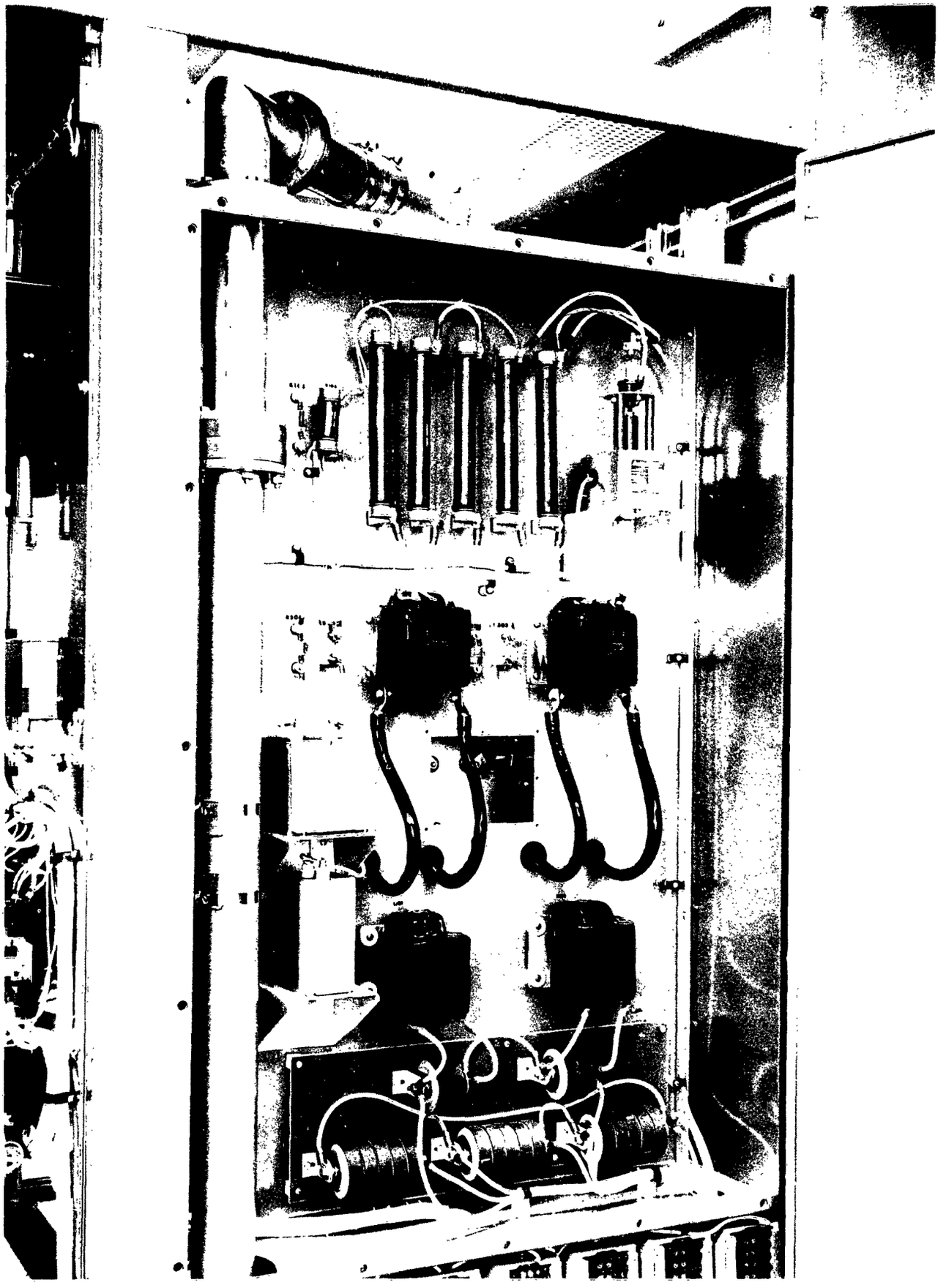


FIGURE 9 - REAR LEFT HAND COMPARTMENT

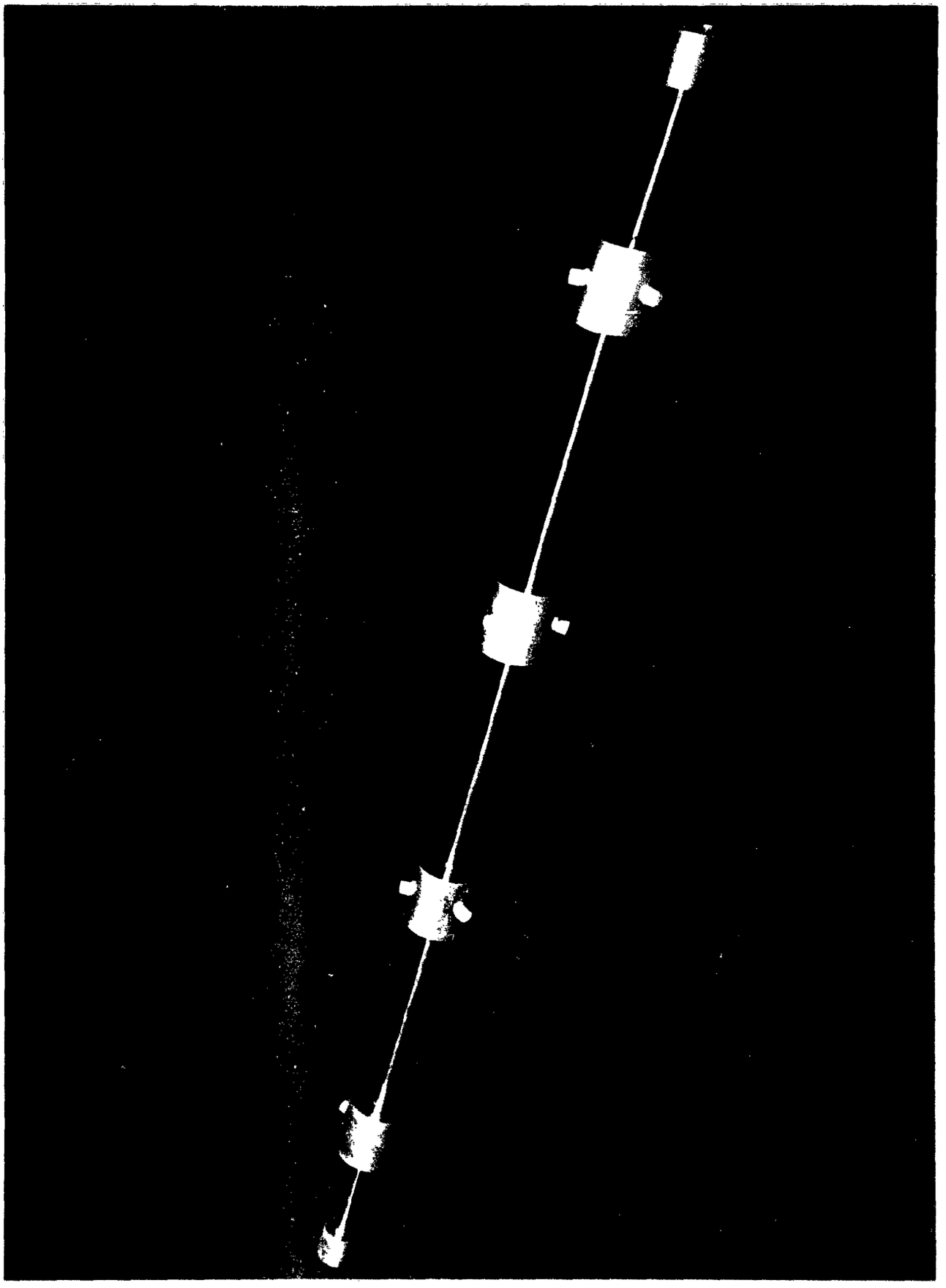


FIGURE 10 - HARMONIC FILTER

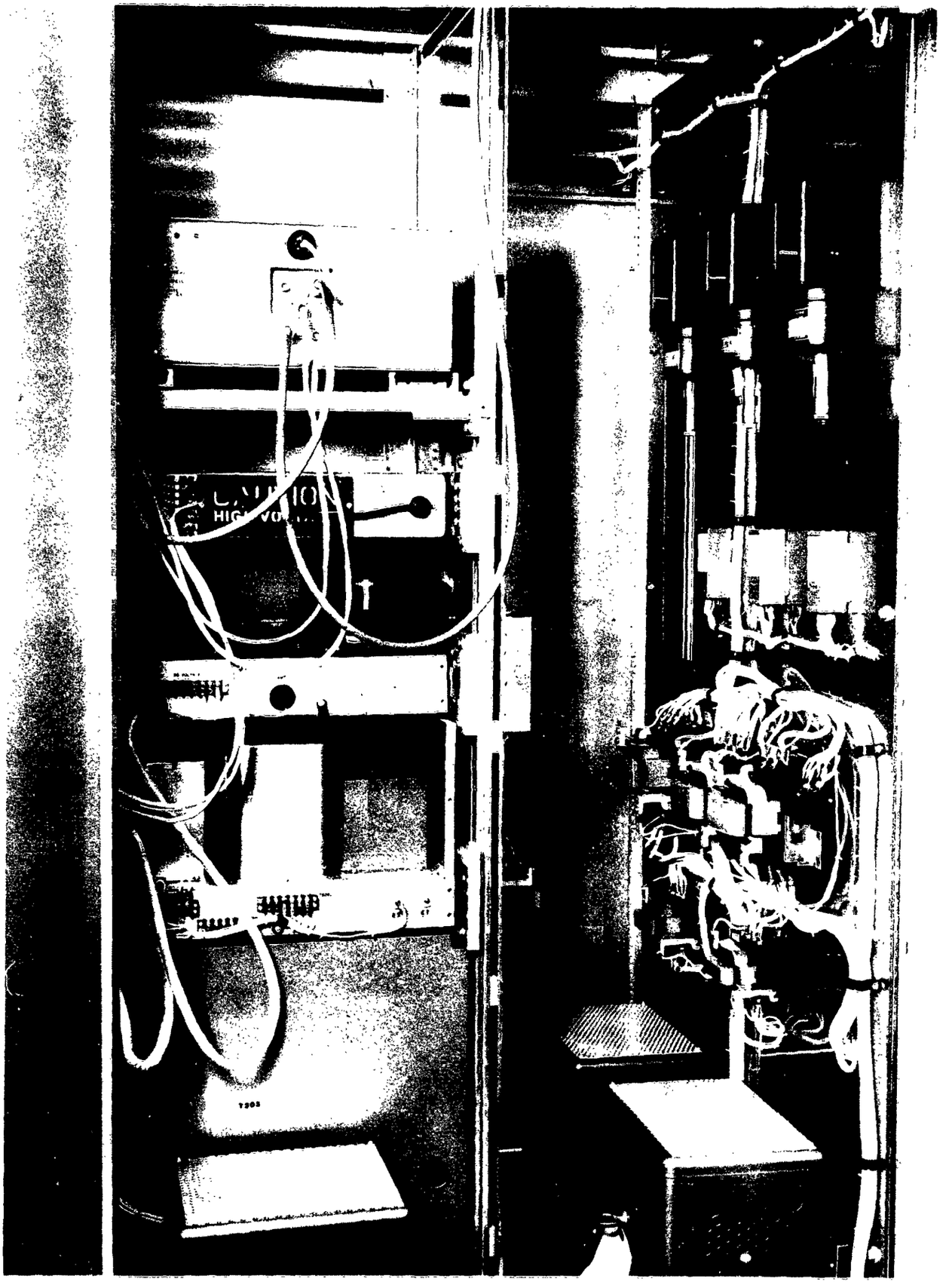


FIGURE 11 - REAR RIGHT HAND COMPARTMENT

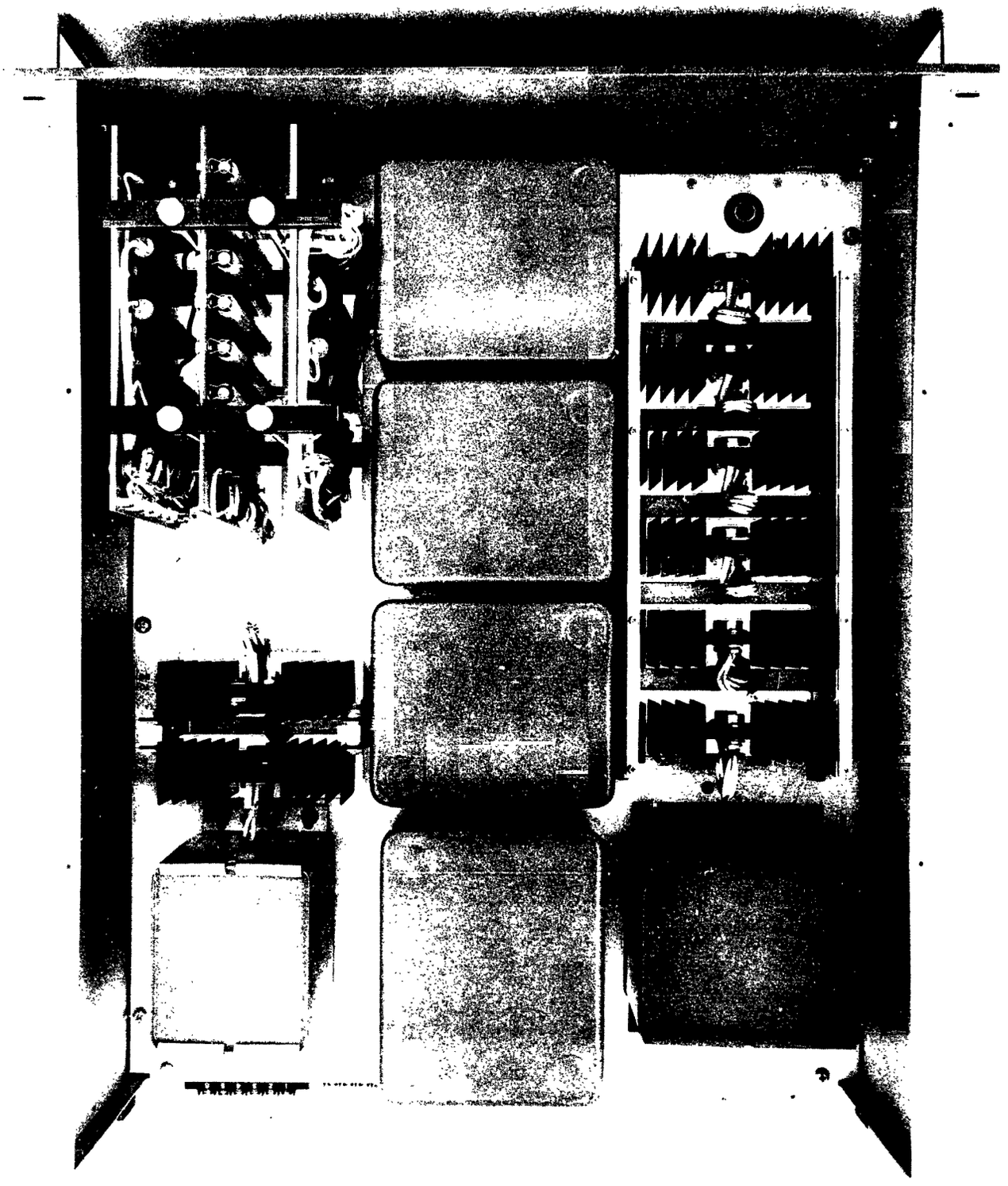


FIGURE 12 - SCREEN VOLTAGE SUPPLY

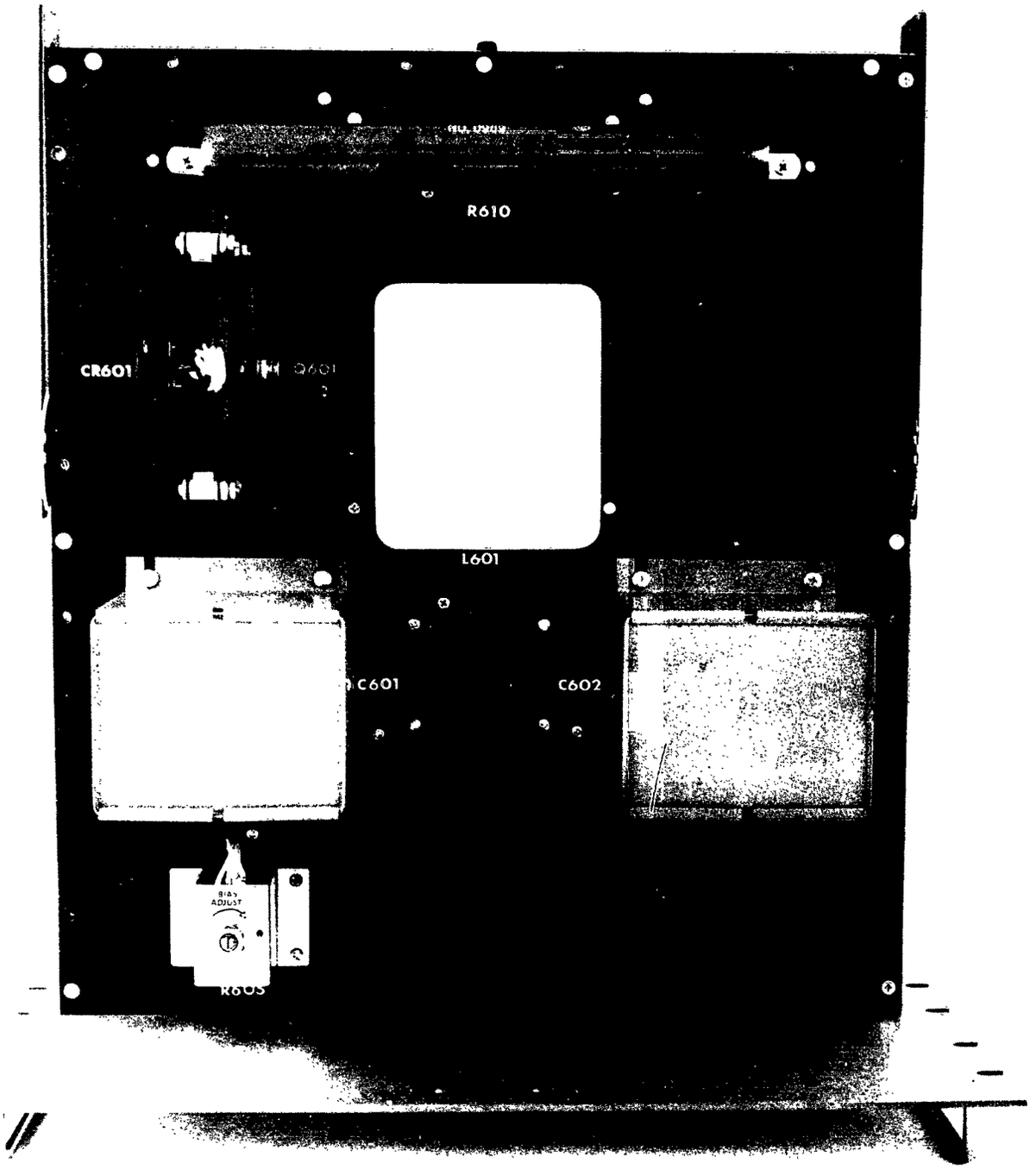


FIGURE 13 - BIAS VOLTAGE SUPPLY